

## **Skin Lesions in Children with Coronavirus Infection**

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**Abstract:** Based on the analysis of literature descriptions of clinical observations of dermatological symptoms in patients with COVID-19, skin lesions can be the first signs of the onset of COVID-19. No direct connection between exanthema in COVID-19 and an allergic history has been identified. Skin stigmas of COVID-19 in children have certain clinical signs. The main mechanisms of exanthema development are associated with an inflammatory reaction of the skin vessels: capillary dilation, blood stasis, increased vascular permeability with the development of hemorrhages and edema, necrosis of the epidermis and dermis, dystrophic changes in cells. The use of systemic glucocorticosteroids contributed to the relief of exanthema. Increasing the awareness of pediatricians about skin changes associated with COVID-19 will allow more effective detection of the infection and care for children.

**Keywords:** dermatology, children, coronavirus infection, skin. signs.

**Relevance.** COVID-19 infection, which has claimed more than 6 million lives since the end of 2019, remains one of the most significant public health problems. According to the European Academy of Dermatovenereology, dermatological lesions in coronavirus infection occur in approximately 30-35% of cases [1].

Children represent a unique group of patients, since COVID-19 often occurs asymptotically, in a mild or atypical form. Skin manifestations in children may be the main or only symptom. While some dermatological signs in children are the same as in adults, other skin manifestations are more common in children and may indicate multisystemic sequelae [2].

The most common manifestations of the new coronavirus infection in children are frostbite. According to the Spanish consensus of 2020, "pseudo-frostbite" was registered in 19% of patients with cutaneous manifestations of COVID-19.

This lesion most often occurs in children and adolescents without concomitant diseases, and is rarely observed in children under 10 years of age. Rashes in 74-100% of cases appear on the feet, as well as on the hands.

Erythematous, violet or purple spots accompanied by edema and infiltration have been described. The areas around the nail plates are usually affected. In patients with chilblains, SARS-CoV-2 infection was mild. In all cases, a favorable outcome was noted with spontaneous regression of lesions [3].

Based on the literature, several theories are considered valid regarding the pathophysiological mechanisms of skin lesions in COVID-19. M. Sachdeva and co-authors believe that the SARS-CoV-2 virus causes the development of lymphocytic vasculitis, which is induced by circulating immune complexes that activate cytokines, and the immune response to SARS-CoV-2 infection causes activation of Langerhans cells, which in turn leads to vasodilation and spongiosis [4].

I.F. Manalo and co-authors attribute a significant role to the development of microthrombosis, leading to a decrease in blood flow to the system of cutaneous microcirculatory vessels, hypoxia and the associated accumulation of deoxygenated blood in the venous plexuses [5].

According to C. Magro and co-authors, activation of the hemocoagulation cascade with the development of infection-mediated DIC syndrome is possible [6].

Frequent manifestations of childhood multisystem inflammatory syndrome associated with SARS-CoV-2 are: non-exudative conjunctivitis, polymorphic rash, desquamation of the skin of the face or perineum, erythema and hard compaction on the skin of the hands and feet [7].

N.N. Potekaev and co-authors associate the development of exanthema with a response to the action of the pathogen, toxins and metabolites of the pathogen in the form of the implementation of several mechanisms: dilation of capillaries; blood stasis, increased vascular permeability with the development of edema and hemorrhages; necrosis of the epidermis and deeper layers of the skin; dystrophic changes in cells (balloon dystrophy); the formation of inflammation (serous, purulent, serous-hemorrhagic) [8].

The current classification of skin manifestations of COVID-19 includes: skin angiitis caused directly by coronavirus infection, against the background of which the walls of small vessels of the dermis are damaged by circulating immune complexes in the form of deposits with infectious (viral) antigens; acrovasculitis, where the acral confinement of the rash is possibly due to concomitant hypoxia against the background of extensive lung damage; toxicoderma, which is not directly associated with coronavirus infection and is a consequence of individual intolerance of patients to certain drugs; urticaria - depending on its origin, the disease can have a dual nature.

On the one hand, urticarial rashes can be a harbinger of the onset of COVID-19 infection or occur along with its first symptoms.

On the other hand, urticaria often develops as a result of drug intolerance and in this case is one of the clinical manifestations of toxicoderma. The acral location of blisters against the background of COVID-19 infection can also be attributed to the specific features of urticarial skin lesions in this viral disease; artificial lesions (trophic changes in facial tissues) are a consequence of the forced prolonged stay of patients in the prone position; papulosquamous rashes and pink lichen are infectious-allergic skin lesions associated with COVID-19 infection.

A clinical feature of pink lichen in coronavirus infection is the absence of a "mother plaque" (the largest element that appears first in the classic course of dermatosis); measles-like rashes and infectious erythema in COVID-19 infection resemble rashes that occur with measles in their clinical characteristics and indicate a pathogenetic proximity to other viral exanthems; papulovesicular rashes (similar to miliaria or eccrine miliaria) occur against the background of subfebrile temperature with multi-day increased sweating in patients. Unlike the classic course, miliaria are characterized by extensive skin lesions [8].

Plotnikova I.A. et al. observed clinical manifestations of newly developed acute dermatoses in children against the background of COVID-19: peeling of the skin on the distal phalanges of the fingers, focal alopecia, onycholysis (6%), acute urticaria, vasculopathy of the fingers of the lower extremities like frostbite, and in children with atopic dermatitis: increased itching, the appearance of blistering elements on the trunk, small vesicles and papules on the palms, the appearance of new petechial elements, spots morphologically corresponding to microthrombosis [9].

According to O.B. Nemchaninova and E.P. Simonova, in 10% of cases, dermatological symptoms manifested during the acute period of COVID-19, sometimes even preceding the appearance of respiratory signs of coronavirus infection; skin manifestations of the disease can serve as an indicator of infection, facilitating its timely diagnosis [10].

According to observations in hospitals, SARS-CoV-2 in children caused pneumonia much less often, and one of the main symptoms instead of loss of smell was tonsillitis, laryngitis, exanthema and gastrointestinal syndrome.

Skin symptoms in 20% of patients were the only symptom of the disease, in 15% of patients the rash was the first symptom of the disease, thanks to which it was possible to detect the virus at an early stage.

The most common dermatological manifestations were observed in 35% of children: urticaria (6%), chills (9%), maculopapular rash (15%), vesicular exanthema (3%), toxicoderma (8%), erythema multiforme exudative (2%).

**Conclusions.** Dermatological symptoms often accompany the course of a new coronavirus infection. Based on the analysis of literary descriptions of clinical observations of dermatological symptoms in patients with COVID-19, skin lesions can be the first signs of the onset of COVID-19. No direct connection between exanthema in COVID-19 and an allergic history was found. Skin stigmas of COVID-19 in children have certain clinical signs. The main mechanisms of exanthema development are associated with an inflammatory reaction of skin vessels: capillary dilation, blood stasis, increased vascular permeability with the development of hemorrhages and edema, necrosis of the epidermis and dermis, dystrophic cell changes. The use of systemic glucocorticosteroids contributed to the relief of exanthema. Increasing the awareness of pediatricians about skin changes associated with COVID-19 will allow more effective detection of the infection and provision of assistance to children.

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