TOPICALITY. Psoriasis is a chronic autoimmune disease characterized by changes in the growth and differentiation of the epidermis. 2-5% of the population of the planet has psoriasis, and it is 30% in the structure of skin diseases. The multifactorial concept of the pathological process in psoriasis determines a wide range of pharmacotherapy of this disease. Modern antipsoriatic agents are not effective enough and have a variety of side effects.

AIM. To summarize the existing scientific literature data concerning the possibility of treating psoriasis with carboxytherapy.

RESULTS AND DISCUSSION. Carboxytherapy is an important part of the treatment and rehabilitation of patients with psoriasis. The antipsoriatic effect of carboxytherapy is realized through the local and resorptive effect of CO₂; anti-proliferative, anti-inflammatory, antioxidant, antimicrobial, anti-hypertrophic, reparative and algogenic. Carboxytherapy in psoriasis promotes tissue detoxification, improves immunity, improves tissue tropism, and eliminates venous-interstitial lymphatic stagnation due to hemodynamic, tissue, and biochemical mechanisms of action of CO₂.

CONCLUSIONS. Carboxytherapy as an additional alternative to pharmacotherapy has a synergistic effect to gether with formulary therapy, but at the same time reduces the dosage of approved drugs and their side effects.

Key words: psoriasis; keratinocytes; carboxytherapy; anti-proliferative; anti-inflammatory effect

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THE THERAPEUTIC POSSIBILITIES OF CARBOXYTherapy FOR PSORIASIS

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INTRODUCTION
Psoriasis is a chronic autoimmune disease characterized by changes in the growth and differentiation of the epidermis due to biochemical, immunological, and vascular anomalies in the body [1-5]. As a result, papules are red, white and gray, hyperkeratosis, cracks, and sometimes pustules appear. In psoriasis, the processes of proliferation and differentiation of keratinocytes are violated: they are formed much more than normal, and therefore many scales appear on the thickened skin. At present, the etiology and pathogenesis of psoriasis is not well understood. 2.5% of the population of the planet have psoriasis, and it is 30% in the structure of skin diseases [5-10]. In psoriasis, the risk of morbidity and mortality due to cardiovascular disorders (myocardial infarction, metabolic syndrome) is 2.9 times higher than with other skin diseases. In addition, psoriasis is often combined with arterial hypertension, rheumatoid arthritis, Crohn’s disease [2-4, 8].

In recent years, a large amount of data has been found on the association of psoriasis with obesity, diabetes mellitus, atherosclerosis, benign prostatic hyperplasia, erectile dysfunction, and many other diseases. Influenza and scarlet fever often precede psoriasis, which indicates the role of the infectious factor in its etiopathogenesis. Thus, in 90% of patients the appearance of psoriasis is observed after the manifestation of streptococcal infection [2, 3].

Stress triggers the release of dermal nerve endings of neuropeptides (substance P, somatostatin), which in psoriasis becomes the link between neurological and inflammatory reactions. These neuropeptides activate macrophages, lymphocytes and other cells that produce inflammatory mediators and initiate biochemical and immunological processes that promote the development of psoriatic skin lesions, or the formation of new foci of psoriasis [3-5, 9, 10]. In psoriasis, immunopathological processes are characterized by the production of interleukins, activation of T-lymphocytes, followed by secretion of the corresponding cytokines, which leads to inflammation, hyperproliferation of keratinocytes, the formation of psoriatic plaques.

In addition, with the intensification of psoriatic rashes, the production of active forms of oxygen and nitric oxide is enhanced. All this leads to pathological changes in the skin, oxidative stress, and an increased level of free radical oxidation violates endothelial function and production of nitric oxide (NO). NO is one of the most important mediators of physiological and pathophysiological processes, the interest in which is steadily growing, since NO is the endothelial relaxation factor, vasodilator, has antiplatelet properties, inhibits pathogenetic growth of blood vessels [2, 11, 12]. One of the mechanisms of keratinocyte hyperproliferation in psoriasis is a local decrease in the activity of inducible NO synthetase and, therefore, insufficient synthesis of NO. It has been established that NO at low concentrations stimulates the proliferation of keratinocytes, and at high concentrations, on the contrary, inhibits cell proliferation and induces their differentiation [9, 13]. Consequently, the multifunctional signal molecule NO, which is among the regulators of growth and differentiation of keratinocytes, with psoriasis can have an ambiguous pathogenetic meaning.

In addition, the study of the pathogenesis of psoriasis indicates the significant role of mental injury, that is, the stress factor in the mechanism of development of this disease.

The multifactor concept and the absence of an unambiguous mechanism of the pathological process in psoriasis determine a wide range of pharmacotherapy of this disease. Drugs that provide anti-inflammatory, hypo-sensitizing and membrane-stabilizing effects by reducing the permeability of the vascular wall, and corrective microcirculation disorders that improve the rheological properties of the blood, contribute to the elimination of the inflammatory response in the dermis and normalize the differentiation of keratinocytes, used for treatment of psoriasis. However, many antipsoriatic agents are not effective enough and have a variety of side effects. Therefore, the restoration of vascular microcirculation, vascularization and architectonics of the dermis, neutralization of oxidative stress, elimination of inflammation and hypoxia are the tasks of modern pharmacotherapy of psoriasis, in addition to suppressing the excessive proliferation of keratinocytes, normalizing their differentiation.

Consequently, the need for an effective and safe method of treatment of psoriasis, long-lasting improving the quality of life of patients, still exists today. Today, convincing clinical experience of effective use in this pathology of carboxytherapy (carbon dioxide therapy) has been accumulated in the off label use therapy style (use of drugs that go beyond the instructions). Carboxytherapy is an important part of the treatment and rehabilitation of patients with psoriasis. The antipsoriatic effect of carboxytherapy is realized through the local and resorptive effect of CO₂: antiproliferative, antiinflammatory, antioxidant, antimicrobial, antihypertrophic, reparative and analgesic [5, 6, 9, 11, 12, 14, 15]. The effects of CO₂ in this pathology are also achieved by improving local vascularization [9, 11, 12].

The anti-inflammatory effect of carboxytherapy is indirectly associated with changes in the expression of cytokines, growth factor, adhesion molecules and cellular receptors to them. [6, 10, 12, 14].

Carboxytherapy, having a systemic effect on the body, increases the level of tissue oxygenation and, as a result, tissue trophicity, the acid-base balance and the rheological properties of blood improve [12, 15]. Inflammation, pain, stimulating effect of NO on keratinocyte proliferation are eliminated due to the listed effects of carboxytherapy [13, 16]. At the same time, under the influence of CO₂ therapy, local correction of tissue hypoxia occurs due to the effect of Verigo-Bohr, stimulation of endothelial growth factors of the skin vessels (neovascularization), neoangiogenesis and fibroblasts, which improves
collagen synthesis, causes vasodilation (the basal tone of arterioles decreases, which contributes to increased blood flow) [6, 14-16]. All of the above effects of carboxytherapy lead to the normalization of keratinocyte differentiation and the restoration of histoarchitecture of the dermis.

Today, carboxytherapy is used as an additional method of treatment for small psoriatic plaques localized in the elbow, knee and other areas [17]. CO$_2$ injections are made subcutaneously, in the immediate vicinity of psoriatic lesions about two times a week. All CO$_2$ injections are performed in the subcutaneous layer in two ways: first, around the plaque (Fig. A); the second – once, in the middle of the psoriatic plaque (Fig. B). The volume of CO$_2$ per session is 20-40 ml. Needle angle 15°-30°, dose 5 ml, needle length 30G is 6-12 mm, the distance between injections is 2 cm. The recommended number of carboxytherapy sessions is 5-15. The number of procedures depends on the local status and subjective feelings of the patient.

Safety of carboxytherapy allows you to use it as an alternative method of treatment of psoriasis, as it not only has anti-inflammatory, antihypoxant, antioxidant effect in psoriasis, but also contributes to tissue detoxification, improves local skin immunity, improves tissue trophism, eliminates venous-interstitial lymphatic stagnation, improves mood, increases the efficiency and quality of life due to hemodynamic, tissue and biochemical mechanisms of action of CO$_2$.

CONCLUSIONS

Today, carboxytherapy is not in the medical recommended regimen for the treatment of psoriasis, in the protocol and in the formulary, however, this method is widely used in dermatology thanks to the off label use therapy. World statistics show that in dermatology, as in other areas of medicine, 60-80 % of drugs are prescribed in off label use style [18]. Dermatologists have clinically established the positive effects of carboxytherapy for psoriasis and transferred their experience to its widespread use in this disease. Carboxytherapy as an additional alternative to pharmaotherapy has a synergistic effect together with formulary therapy, but at the same time reduces the dosage of approved drugs and their side effects [1, 19, 20].

Conflict of interests: authors have no conflict of interests to declare.

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