

## PSYCHOPATHOLOGICAL DISORDERS AS COMORBIDITY IN PATIENTS WITH PSORIASIS (REVIEW)

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Psoriasis is a common, chronic inflammatory skin disease with a complex etiology involving genetic risk factors and environmental triggers. The reported prevalence of psoriasis in countries ranges between 0.09% and 11.43%, making psoriasis a serious global problem with at least 100 million individuals affected worldwide [24,29]. Patients with early onset, or type I psoriasis, tended to have more relatives affected and more severe disease than patients who have a later onset of disease or type II psoriasis. Psoriasis vulgaris (plaque psoriasis) is the most common form of the disease (affecting 70% of the patients) and usually presents as symmetrical erythematous papules or plaques covered with thick silvery scales located on the extensor side of the elbows and knees, scalp, and lumbosacral area.

The serious medical and social relevance of the problem is determined by the increase in morbidity, damage of various tissues and organ systems, development of resistance to traditional therapy, and decrease in the quality of life of patients [3,6,16]. Psoriasis is often referred to as a group of so-called “diseases of civilization”. This is due to the appearance of “scissors” between the possibilities of the biological nature of man and living conditions at the present stage of development of society (fast pace of life, increased emotional stress, requiring tremendous nervous and intellectual effort).

Psoriasis arises through interactions between hyperproliferative keratinocytes and infiltrating, activated immune cells. The cellular and molecular contributions to the overactive immune response were further elucidated. It was found that T-cells, particularly those with Th1 and Th17 polarization, are heavily present in psoriatic lesions. Psoriatic skin is infiltrated by a myriad of other immune cells including macrophages and innate immune cells, as well as an increased amount of endothelial cells (angiogenesis); these other cell types may certainly also play a role in psoriasis pathogenesis [10,12,29].

To date, large-scale epidemiological studies in many countries have shown that one third of all current diseases seen in studied populations meet the diagnostic criteria of more than one disorder. Possible coexistence of two and/or more syndromes (trans-continental comorbidity) or diseases (trans-syndrome comorbidity) in one patient pathogenetically interrelated or coincident in time (chronological comorbidity). The development of comorbidity is most likely based on the interplay of the pathogenesis of combined diseases and tends to increase with age. Coexistence and mutual influence of diseases, as a rule, complicate the diagnosis, which reflects the essence of the pathological process and becomes more and more important in the assessment of the disease from different point of views – medical, legal, insurance. Registration and correction of changes in the physical health of patients with psoriasis become more relevant and can significantly affect the parameters of disease management.

Psoriasis has also been identified as a multisystem chronic inflammatory disorder associated with multiple comorbidities. Psoriatic arthropathy as a classic autoimmune association is registered in 15-45% of cases. Examples of other comorbidities that are more common in individuals with psoriasis and may warrant intervention include obesity, metabolic syndrome, hypertension, diabetes mellitus, Crohn's disease, multiple sclerosis and others

[2,6,24,25].

Significant lack of knowledge remains with respect to the characteristics of psychopathological disorders in patients with psoriasis and their effect on the course of dermatoses, despite the large number of publications on concomitant pathology. The aim of the study is to discuss psychological and mental disorders in patients with psoriasis and identify possible common mechanisms of pathogenesis based on the analysis of data of relevant scientific literature.

**Results and discussion.** Psychological and mental disorders are observed in 40-70% of dermatologic patients according to the results of research [2,3,22]. The results of a multicenter study involving about 5 thousand people showed that depression, anxiety and suicidal inclinations were 10.1, 17.2 and 12.7% in patients with skin diseases, compared with 4.3, 11.1 and 8.3% in the control group respectively [13].

Psoriasis has stronger associations with mental disorders than other dermatological diseases. Patients may have specific psychopathological features that do not correspond to the degree of skin damage. A controlled study showed that 84% of patients with psoriasis had concomitant mental disorders [22].

Skin diseases are characterized by a number of general characteristics (duration and unpredictability of the disease, a strong feeling of itching, pronounced rash, lack of social support), leading to neuroticism, the development of depressive states. Loneliness and irritability, which can cause indignation and aggression, expressed distrust of others, a firm belief in the exogenousness of their disease complicate the life of the patient and his family, communication with doctors, adherence to the therapeutic regime [2,8].

About 80% of patients with psoriasis indicate a negative impact of the disease on quality of life. These are feelings associated with external manifestations, especially in open areas (frustration, anxiety and low self-esteem, impaired functioning as an active member of society, self-isolation), pronounced scaling, burning and tingling sensation, joint pain, emotional distress, sleep disturbance, physical disability in severe clinical forms, dissatisfaction and disappointment with treatment outcomes, which often require significant material costs and time loss [7, 15, 18]. There is a decrease in the mental and physical quality of life in patients with psoriasis vulgaris and psoriatic arthritis, and the degree of change in the indicators is closely related to the age of patients, the duration of the disease, the frequency of exacerbations and the presence of concomitant pathologies [8, 24]. Psoriasis patients are characterized by psychological maladaptation, decreased levels of subjective well-being, stress of psychological protection by type of denial and displacement. Hysterical and hypochondriacal conditions, excessive cruelty, suspicion, heightened conflict, negative assessment of prospects, distrust are determined [2, 17].

Psoriasis patients are less socially active. They refuse to visit the pool (72%), public baths (64%), are ashamed of their condition (55%), avoid places crowded with people (50%), report the effects of psoriasis in an intimate life, wear unattractive clothes, try to hide rash (46%), avoid sports (40%), do not use hairdressing services (34%), afraid of losing their job (15%) [7, 9]. Al-

most half of patients consider treatment and everything related to it a much bigger problem than psoriasis itself, which affects quality of life. The decline in the quality of life of patients with psoriasis can be compared to a similar rate in some diseases (diabetes, chronic heart failure, chronic obstructive pulmonary disease, cancer) [29].

Study of psychoneuroimmune interactions in modern dermatology is one of the priority directions. Research indicates that up to 40% of dermatology outpatients possess an underlying psychiatric disorder that either contributes to or is caused by a skin complaint, and in depth studies of skin biology are consistent in reporting the link between compromised epidermal barrier function and psychological stressors [32]. It is proved that the skin not only contains the receptors of almost all neurotransmitters and peptide hormones of the hypothalamic-pituitary-adrenal system, but also can synthesize them.

It has been established that many characteristic signs of psoriasis are the Koebner phenomenon, the horizontal alternation of layers of parakeratosis in psoriatic plaques, the symmetry of rashes, where itching can occur due to the release of neuropeptides by nerve fibers, which, if possible, are a connecting link between neurological and inflammatory reactions. Neuropeptides such as substance P, a peptide associated with the calcitonin gene, and others, are released from the nervous tissue under the influence of exogenous and endogenous stimuli. These substances activate macrophages, lymphocytes and inflammatory mediators, initiate a chain of immune and metabolic processes (release of histamine, heparin, leukotriene, prostaglandin D<sub>2</sub>, proteinase), which leads to increased vascular permeability and vasodilation, promoting the development of isomorphic reactions. At the same time, the number of nerve growth factor receptors on the surface of damaged epidermal cells is increasing [28].

Dermatologists and patients alike have long been aware of the complex interplay between mind and skin. Cutaneous disease has not only the potential to considerably influence one's mental and emotional wellbeing, but may also be stimulated by the detrimental effects of various negative psychological states itself. The importance of stress in the development of psoriasis is indisputable. However, the mechanisms that influence the onset of a debut or relapse remain poorly understood. Probably inflammation is a unifying factor [16, 31]. It is established that psychological stress increases the level of inflammatory markers – C-reactive protein, tumor necrosis factor alpha (TNF  $\alpha$ ), some interleukins (IL), which over time increases the inflammatory potential of circulating cells of the immune system and leads to exacerbation of psoriasis.

Mental disorders in patients with psoriasis today are at the center of attention of researchers. The main comorbidities of psoriasis of the psychological and psychiatric profile include alexithymia, anxiety and depression [7, 17, 18]. The development of psoriasis is associated with severe mental upheavals and severe negative emotions in more than 50% of patients, with the interval between cause and effect ranging from several days to 2-3 weeks. In addition to the temporal relationship between the effect of emotional stress and the manifestations of skin pathology, there is often a clear parallelism between the severity of the disease, the prevalence, the duration, the intensity of emotional disorders, the association with clinical depression, clinical anxiety and the thought of suicide [3, 23, 31]. Psychiatric rigidity is characteristic of patients with psoriasis. They have increased constitutional anxiety, a greater tendency to depression than patients with atopic dermatitis [5].

It would be noted that mental disorders are especially severe when psoriasis develops in childhood. Sick children face behavioral constraints, are unsure of themselves, introverted, prone to mood swings, have difficulty communicating with their parents and other people and the opposite sex, and have difficulty in pursuing a professional career [9, 31]. Inadequate behaviors such as the protective cognitive and emotional mechanisms inherent in childhood are very common in psoriasis and increase the risk of anxiety disorders.

The early onset of psoriasis may be associated with personality traits, namely, anxiety (difficulty recognizing and describing their own emotions), which determine the high sensitivity of patients to stress factors. It is believed that psoriasis beginning after age of 50 years has a high chance of human development changes in personality traits and a greater likelihood of development of hypochondria. Men show increased emotional tension, instability, depressive tendencies, somatization of anxiety, and similar tendencies for women, but autism, impracticality and subjectivism are more commonly recorded [2]. It is noted that in some cases the manifestations of psoriasis may be significantly reduced or completely disappeared without the specific therapy on the background of treatment with psychotropic drugs that improve the mental state of patients [23].

According to studies, from 5 to 23% of the healthy population exhibit certain alexithymic traits. Alexithymia was found to be present in 50-60% of patients with psoriasis [5, 17]. Patients with psoriasis have a lower emotional background, dissatisfaction with the life situation and emotional tension with the elements of agitation, as well as fatigue, lethargy, passivity and fatigue more pronounced than in patients with atopic dermatitis. Currently, depression is considered to be a multi-faceted mental disorder characterized by depressed mood, mental and cognitive impairment, changes in psychomotor activity, as well as various somatic complaints (headache, insomnia, appetite disorders, etc.). Thus, a study using Beck Depression Inventory – a methodology for qualitative and quantitative assessment of depression showed that 12-24% and 48% of patients with psoriasis had severe depression and anxiety respectively [13]. The frequency of cases of depression and anxiety in patients with psoriasis is significantly higher than in the general population, as well as in other chronic dermatoses (pemphigoid, vitiligo, atopic dermatitis, etc.) [5, 22].

Depression may be due to the presence of a chronic skin disease or the cause of its occurrence, severe course. Some authors believe that in patients with psoriasis dominated by «secondary» depressive states, the emergence of which is associated with the underlying disease, any depression can adversely affect the course of psoriasis [2, 3]. Low self-esteem and social maladaptation lead to patients' inability to cope with the social consequences of psoriasis, which in turn leads to depression. Physical defects and stigmatization, low socio-cultural level, loneliness and female sex were the reason for the increased risk of dermatosis depression [22]. Symptoms of depression are more common in patients with facial and genital defects, correlated with PASI and dissatisfaction with treatment outcomes [15].

From all the psychiatric comorbidities reported in the literature, the most prevalent seem to be sexual and sleep disorders. Sexual disturbances (71.3%) and sleep disturbance (more than 50%) are among the most common psychiatric abnormalities in patients with psoriasis [4, 19]. Sleep disorders (initial insomnia, increased number of nocturnal awakenings, early morning awakening and daytime sleepiness) in psoriasis may be secondary to depression. Sleep changes directly through nocturnal itching

and pain that results in movement disorders, circadian rhythm or interrupted sleep, causing breathing difficulties in sleep.

One of the most common causes of insomnia is an increase in the level of proinflammatory cytokines (TNF  $\alpha$ , IL-6) during night apnea in psoriasis [19]. Psoriatic arthritis, plaque forms of psoriasis, localization of the process on the palms, soles, or head may further interfere with the quality of sleep associated with severe itching and pain syndrome [7].

Addiction and abuse of psychoactive substances, somatoform disorders, schizophrenia or other psychoses, bipolar disorders are also often associated with psoriasis [17].

Depression and psoriasis may coexist without obvious causal relationships, jointly developing along general biological mechanisms. The role of substance P as a connecting link between psoriasis, itching and depression is emphasized. Depression leads to an increase in the level of this neurotransmitter, which causes proliferation of keratinocytes, inflammation of the skin, activation of lymphocytes and increases the severity of psoriasis [28].

Different physiological pathways can be involved in the relationship between exacerbations of psoriasis and mood disorders such as depression, anxiety. One of them, more characteristic of depressive states, includes pathological activation of the hypothalamic-pituitary-adrenal system [32]. There is an activation of the cascade of neurohormonal processes with increased synthesis of corticotropin-releasing hormone, proinflammatory peptides that modulate transcription of DNA cells and immune reactions in response to stress factors (ultraviolet irradiation, bacterial and viral infections, etc.). Immunohistochemical studies have shown that keratinocytes are involved in the development of confirmed inflammation increased expression of corticotropin-releasing hormone in the psoriasis skin.

On the other hand, the sympathetic nervous system, mainly  $\alpha$ -adrenergic receptors, is involved in the formation of inflammation and the synthesis of proinflammatory cytokines. Norepinephrine secretion revealed in response to stress in patients with psoriasis compared with healthy subjects [1]. Depression and anxiety can contribute to the exacerbation of inflammatory skin disorders, activating both the hypothalamic-pituitary-adrenal and sympathetic nervous systems. Effects of chronic stress on the development of immunosuppression or immunoregulation are available [26].

The high level of proinflammatory cytokines, TNF  $\alpha$ , IL-1, IL-2, IL-6, IL-8, IL-10, interferon  $\gamma$ , prostaglandin E<sub>2</sub>, C-reactive protein is a common phenomenon for psoriasis and depression within the vicious circle [10]. Depression increases the level of proinflammatory cytokines and activates the mechanisms associated with the cytokine system, which can lead to the onset or exacerbation of psoriasis. The use of TNF  $\alpha$  inhibitors (etanercept, adalimumab) for the treatment of patients with psoriasis leads to improved dermatosis, reduced fatigue and regression of depressive symptoms [20]. However, the induction of inflammation in psoriasis can accelerate mood swings, including depressive symptoms.

Various neuroimmunological studies suggest that anti-inflammatory cytokines are not the only biomarkers that bind depression and psoriasis. The association of low levels of melatonin, depression and vulgar psoriasis is known [10, 27]. It has been previously established that normalization of melatonin levels in depression contributes to the regression of psoriatic lesions. It is likely that both conditions can provoke one another through common links of pathogenesis

Melatonin (N-acetyl-5-methoxytryptamine) is a hormone with multiple functions in humans, produced by the pineal

gland. Serum melatonin levels exhibit a circadian rhythm with low levels during the day, rise in the evening and maximum levels at night between 2 and 4 am and gradually falls during the second half of the night. Melatonin performs various functions including induction of sleep, synchronization of biological rhythms, vasoregulation and others [30]. The paracrine, autocrine and antioxidant effects of melatonin are modulated by its receptors, although some of the biological effects are induced by the receptor-independent route. Well-known immunomodulatory properties of melatonin, which affects the immune system and regulates cytokine synthesis by immunocompetent cells. It has been established that melatonin causes a decrease in the expression of proinflammatory cytokines such as IL-6, IL-8 and TNF  $\alpha$ , thus improving the clinical course and may weaken the severity of immune-inflammatory diseases [11]. Hence, melatonin improves the clinical course of diseases which have an inflammatory etiology.

Disturbances in the regulation of melatonin production and its receptor function are associated with a variety of disorders, including depression, diabetes type 2, rheumatoid arthritis, and other immune-dependent diseases [27]. Night time levels of melatonin levels in serum showed a significant decline in psoriasis cases, as compared with controls [21]. Reducing the level of melatonin may be due to the Kébnér phenomenon characteristic of the progressive stage of psoriasis. It has been suggested that the absence of melatonin as a result of pinealectomy in laboratory rats led to a delay in wound healing, and the addition of melatonin to animals improved the skin's regenerative properties [27]. Modulation of melatonin secretion may be a possible alternate mechanism by which methoxypsoralens and phototherapy help in the management of psoriasis and associated depression. Recent reports suggest that antidepressants such as agomelatine (a melatonin receptor agonist) weaken inflammatory changes in depression, reducing the release of proinflammatory cytokines from activated microglia, which correlates with improving the function of monoamine neurotransmitters [11, 14].

The results of study indicate that the synthetic analogue of the epiphysis neuropeptide normalizes sleep disturbance, modulates melatonin secretion, and has immunomodulatory effects in psoriasis patients [4]. Synthetic melatonin can be a complement to standard therapy for patients with psoriasis and its comorbidity.

Mental and psychological disorders in patients may be primary, but more often secondary to psoriasis. Patients would benefit from a psychodermatologic approach. It is very important to improve the skills of dermatologists to detect psychiatric disorders and psychological problems in patients in a timely manner, refer them to specialists of the appropriate profile, which will help to improve the effectiveness of psoriasis therapy and improve the quality of life of patients.

**Conclusions.** The results of the analysis of literary sources have shown that anxiety, alexithymia, depressive disorders are one of the common comorbid states in patients with psoriasis. Psoriasis and comorbidity are interrelated at the level of pathogenetic processes, with the key link being immune inflammation. Assessment of the psychological and psychiatric status of a patient with psoriasis with prolongation of the diagnostic route (if necessary) will contribute to the timely detection of comorbid pathology and optimize the therapeutic tactic.

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## SUMMARY

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Psoriasis is a systemic immune-mediate disease associated with increased risk of comorbidities. Psychopathological disorders in patients with psoriasis remain poorly understood, despite the large number of publications. The aim of the study is to discuss psychological and mental disorders in patients with psoriasis and identify possible common mechanisms of pathogenesis based on the analysis of data of relevant scientific literature.

The development of psoriasis is associated with the expressed negative emotions in more than half of patients. Most psoriasis patients indicate a negative impact of the disease on quality of life. The main comorbidity of psychological and psychiatric psoriasis include alexithymia, anxiety and depression including sexual and sleep disorders. Mental and psychological disorders in patients may be primary, but more often secondary to psoriasis.

Studies show the involvement of inflammatory mediators (proinflammatory cytokines) and melatonin in the pathogenesis of both psoriasis and psychopathological disorders, with immune inflammation being a key link. Assessment of psychological and psychiatric status will allow timely identification of comorbid pathology and will optimize the therapeutic tactics of treating patients with psoriasis.

**Keywords:** psoriasis, comorbidity, anxiety, alexithymia, depression, pathogenesis proinflammatory cytokines, melatonin.

## РЕЗЮМЕ

### ПСИХОПАТОЛОГИЧЕСКИЕ РАССТРОЙСТВА КАК КОМОРБИДНОСТЬ У БОЛЬНЫХ ПСОРИАЗОМ (ОБЗОР)

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Псориаз является системным иммуноопосредованным заболеванием, связанным с повышенным риском возникновения коморбидных заболеваний. Психопатологические расстройства у пациентов с псориазом по сей день недостаточно изучены, несмотря на большое количество публикаций. Целью исследования является анализ психологических и психических расстройств у пациентов с псориазом и выявление возможных общих механизмов патогенеза на основании изучения научной ретроспективной и текущей литературы.

У большинства больных развитие псориаза связано с выраженными негативными эмоциями. Больные псориазом часто указывают на негативное влияние заболевания на качество жизни. К основным коморбидностям псориаза психологического и психиатрического профиля принадлежат алекситимия, тревога и депрессия, сексуальные расстройства и нарушения сна. Психические и психологические расстройства у больных могут быть первичными, но чаще они являются вторичными по отношению к псориазу.

Исследования демонстрируют участие медиаторов воспаления (провоспалительные цитокины) и мелатонина в патогенезе как псориаза, так и психопатологических расстройств, при этом ключевым звеном является иммунное воспаление. Оценка психологического и психиатрического статуса больного псориазом обеспечит своевременное выявление коморбидной патологии, что позволит оптимизировать лечебную тактику.

## რეზიუმე

ფსიქოპათოლოგიური დარღვევები როგორც კომორბიდული დაავადება პაციენტებში ფსორიაზით (მიმოხილვა)

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ხარკოვის დიპლომის შემდგომი განათლების სამედიცინო აკადემია, უკრაინა

ფსორიაზი წარმოადგენს იმუნური პასუხით განპირობებულ სისტემურ დაავადებას, რომელსაც თანახლავს კომორბიდული პათოლოგიის განვითარების დიდი რისკი. მიუხედავად ჩატარებული კვლევების და პუბლიკაციების დიდი რაოდენობისა, ფსორიაზით პაციენტებში დღემდე არ არის შესწავლილი ფსიქოლოგიური დარღვევები.

კვლევის მიზანს წარმოადგენს ფსორიაზით დაავადებულ პაციენტებში ფსიქოლოგიური და ფსიქიური დარღვევების განხილვა და სამეცნიერო ლიტერატურის ანალიზის საფუძველზე პათოგენეზის შესაძლო საერთო მექანიზმების იდენტიფიცირება.

ფსორიაზის განვითარება ასოცირდება გამოსატულ ნეგატიურ ემოციებთან. ფსორიაზის დაავადების ძირითად თანმხლებ კომორბიდულ პათოლოგიას წარმოადგენს ფსიქოლოგიური და ფსიქიკური პროფილის ალექსიტიმია, შფოთვა და დეპრესია, ასევე სექსუალური დარღვევები, ინსომნია. ფსიქიკური და ფსიქოლოგიური დარღვევები პაციენტებში შეიძლება იყოს პირველადი, მაგრამ უფრო ხშირად მეორეხარისხოვანი ფსორიაზის მიმართ.

კვლევებმა აჩვენა, რომ ფსორიაზისა და ფსიქოპათოლოგიური დარღვევების პათოგენეზში აღინიშნება ანთებითი შუამავლების (ანთების ციტოკინები) და მელატონინის მონაწილეობა, რომელთა საკვანძო როლს წარმოადგენს იმუნური ანთება. ფსორიაზით დაავადებული პაციენტის ფსიქოლოგიური და ფსიქიკური სტატუსის შეფასება ხელს შეუწყობს კომორბიდული პათოლოგიის დროულ გამოვლენას და მეურნეობის ტაქტიკის ოპტიმიზაციას.

## CARDIOMYOCYTE DNA CONTENT AND ITS LINK TO CSE/H<sub>2</sub>S SYSTEM IN THE HEART OF EXPERIMENTAL DIABETIC RATS

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Diabetes mellitus (DM) is an important health problem because of high prevalence, rapid complications and high mortality [27]. One of the serious complications of diabetes is diabetic cardiomyopathy (DCM). Diabetic heart injury is characterized by several main mechanisms such as impaired insulin signaling, endoplasmic reticulum stress, mitochondrial dysfunction, sympathetic nervous system activation, oxidative stress, inflammation, impaired coronary microcirculation which lead to myocardial fibrosis, hypertrophy and heart failure [1,8,19,22].

One of the crucial factors in pathogenesis of DCM is disintegration of cell cycle and activation of pro-apoptotic pathways [3,13], but the molecular mechanisms behind these changes are still unknown. It has been shown recently that hydrogen sulfide (H<sub>2</sub>S) is an important modulator of cardiomyocyte proliferation and apoptosis, and is involved in the regulation of cardiovascular functions and insulin secretion [2,7,15]. However, the role of the CSE/H<sub>2</sub>S system and disruption in proliferation and apoptosis in diabetic heart remains unclear.