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CHARACTERISTICS OF DERMAL BLOOD CIRCULATION AND SKIN MICROBIOCENOSIS IN PATIENTS WITH LICHEN PLANUS AND RATIONALE FOR OPTIMIZED THERAPY OF THIS DERMATOSIS

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Introduction. The unclear etiology, complex pathogenetic mechanisms of lichen planus (LP) emphasize the necessity for further investigation into specific triggering factors – in particular, disturbances in dermal microcirculation and skin microbiocenosis – which play a significant role in the manifestation of this dermatosis and may contribute to the optimization of therapeutic strategies.

The aim of the study was to assess the functional state of dermal microcirculation and skin microbiocenosis in patients with different clinical forms of lichen planus.

Materials and methods. The study included 91 patients with LP (59 women and 32 men), aged 21–65 years. The typical form of LP was diagnosed in 69 patients (75.8 %), the hypertrophic form in 12(13.2 %), and the pigmentary form in 10(11.0 %). The functional state of dermal microcirculation was assessed using laser Doppler flowmetry. Bacteriological (culture-based) analysis of the skin microbiota was also performed, sampling from both lesional and unaffected skin, with enumeration and identification of microbial colonies.

Results. Patients with typical, hypertrophic, and pigmentary forms of LP exhibited a stagnant-stasis type of circulation in affected areas and a spastic type in visually unaffected areas. Microbiological analysis of LP lesions revealed polymicrobial colonization, while unaffected skin areas predominantly showed colonization by two microbial species. These findings underscore the significance of dermal microcirculation disorders and altered skin microbiocenosis in the pathogenesis of LP.

Conclusions. Optimization of therapy in patients with LP – particularly through targeted correction of dermal microcirculation impairments and individualized antibiotic therapy aimed at restoring the normal skin microbiota – can enhance the effectiveness of treatment.

Keywords: lichen planus, dermal microcirculation, skin microbiocenosis.

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ХАРАКТЕРИСТИКА СТАНУ ДЕРМАЛЬНОГО КРОВООБІГУ І МІКРОБІОЦЕНОЗУ ШКІРИ У ХВОРИХ НА ЧЕРВОНИЙ ПЛЕСКАТИЙ ЛИШАЙ ТА ОБГРУНТУВАННЯ ОПТИМІЗАЦІЇ ТЕРАПІЇ ЦЬОГО ДЕРМАТОЗУ

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У статті представлено результати досліджень стану дермального кровообігу та результати бактеріологічного дослідження мікрофлори шкіри у хворих на червоний плескатий лишай (ЧПЛ). Встановлено, що у хворих на типову, гіпертрофічну і пігментну форми цього дерматозу реєструвався застійно-стазичний тип кровообігу в ділянках ураження шкіри та спастичний тип – у ділянках візуально незміненої шкіри. Мікробіологічними дослідженнями в ділянках ураження шкіри хворих на ЧПЛ виявлено наявність поліінфікування, що було представлено асоціацією трьох і більше різних мікробних агентів, зокрема *S. aureus* + *S. pyogenes* + *S. epidermidis* + «інші мікроорганізми», а в ділянках візуально незміненої шкіри – біінфікування. Аналіз проведених досліджень вказує на значення порушень дермального кровообігу й мікробіоценозу шкіри в патогенезі ЧПЛ та потребує оптимізації терапевтичної корекції, що сприятиме підвищенню ефективності лікування хворих на цей дерматоз.

Ключові слова: хворі на червоний плескатий лишай, дермальний кровообіг, мікробіоценоз шкіри, обґрунтування оптимізації терапії.

Introduction

Lichen planus (LP) belongs to the group of common skin diseases, as its proportion in the structure of dermatoses was 1–2 %. The need for further study of LP was driven by unclear etiology, complex pathogenic mechanisms, and variable clinical outcomes, including treatment-resistant forms of this dermatosis [1–4].

This dermatosis was characterized by a variety of clinical manifestations, which creates additional difficulties in making a diagnosis. In addition to typical forms, there were atypical clinical manifestations of LP. Combinations of several variants of the course were often encountered, for example – atrophic and annular. On visible mucous membranes, erosive-ulcerative and exudative-hyperemic forms were quite often identified [17]. On smooth skin, annular, linear foci of lesions were possible, as well as

pigmented macules. Atrophic changes with hyperkeratotic overlays, verrucous proliferations or herpetiformly arranged were observed [5]. At present, this dermatosis with localization of rash elements on the oral mucosa was considered as a potentially precancerous condition with the possibility of development of epithelioma [6].

Among the trigger factors of LP manifestation, the following were distinguished: neurogenic, immune, infectious, toxic-allergic, metabolic, etc. [7–13]. To date, insufficient attention was paid to the study of the significance of dermal blood circulation in the development of this pathological process. It was established that in the dermis of skin lesion foci of patients with LP, the vessels of the papillary layer were dilated, and the walls of arterioles were moderately sclerosed. In addition, perivascular band-like infiltrates were observed, which contain fibroblasts, polynuclears, mast cells, lymphoid elements. Arterioles located in the reticular layer often have a narrowed diameter, and their walls were infiltrated predominantly by lymphocytes [14–16].

It has also been proven that in LP, microcirculatory disorders occur, which consist in changes in the structure and barrier function of microvessels. The presence of spasms of the arterial link, signs of venous hyperemia and venous stasis have been established, which lead to changes in the trophism of the skin and mucous membrane and a decrease in their resistance, which contributes to the complicated course of this dermatosis [1; 14–16].

A more detailed study regarding the possible influence on the development of LP also requires an assessment of the significance of microorganisms that were located in the skin foci of the pathological process, since the course of this dermatosis was accompanied by structural restructuring of the skin microbiocenosis, which was manifested by a decrease in the number of symbionts and an increase in the proportion of opportunistic microorganisms [18]. The presence in patients with LP of qualitative and quantitative changes in the microflora of the oral mucosa leads to the development of dysbiosis of varying severity, and *Candida albicans* contributes to a more severe course of the dermatosis [19; 20].

Thus, the above data indicate the presence of a number of insufficiently studied mechanisms of development of LP. In particular, in patients with this dermatosis, approaches to assessing the state of skin vascularization were unstructured, there was no analysis of microbial colonization in the lesion foci, and criteria for assessing the severity of corresponding changes have not been traced. The relationship between the corresponding factors of dermatosis development remains poorly understood. This indicates the expediency of further study of the pathogenetic links of LP development and the search for additional therapeutic means to optimize the complex treatment of patients with this dermatosis.

Aim of the study. Determination of disorders of the functional state of dermal blood circulation and skin microbiocenosis in patients with different clinical forms of LP and pathogenetic rationale for optimizing complex therapy of this dermatosis.

Materials and Methods

The studies were carried out in compliance with the provisions and principles of the Helsinki Declaration of the World Medical Association "Ethical principles for medical research involving human subjects" (conclusions of the bioethics commission of Bogomolets National Medical University, Protocol No. 187 dated 23.09.2024). The study included 91 patients with LP who, during the period 2024–2025, underwent examination and treatment at the clinical bases of the Department of Dermatology and Venereology with a course in cosmetology of Bogomolets National Medical University: the dermatovenerological department of St. Michael's Clinical Hospital of Kyiv and the Municipal Non-Profit Enterprise "Dermatovenereology in Kyiv". All patients provided written consent for the processing of personal data. The age of the examined patients ranged 21–65 years; according to sex, there were 59 women and 32 men. The duration of LP disease ranged from 1 week to 5 years. In each case, the diagnosis was made on the basis of clinical examination of the patient, taking into account patient complaints, anamnesis data, the nature of the clinical picture of the dermatosis, the extent of the pathological process on the skin, and the presence of complications. All patients also underwent general clinical examination and, if necessary, consultation with related specialists. The determination of the state of the microcirculatory bed of the skin was carried out in 91 patients with LP using laser Doppler flowmetry (LDF) on the device "Vingmed SD-100" (company "Medata", Sweden). The state of dermal blood circulation was determined, in particular, generalizing indicators: microcirculation index (MI), standard deviation of the microcirculation index (SD), coefficient of variation (CV); amplitude spectrum: amplitude of slow oscillations (ALF), amplitude of pulse oscillations (ACF), amplitude of fast oscillations (AHF); components of the mechanisms of modulation of dermal tissue blood flow: the first component of the active mechanism of modulation of tissue blood flow (1CAMTBF = ALF/MI), the second component of the active mechanism of modulation of tissue blood flow (2CAMTBF = SD/ALF), the first component of the passive mechanism of modulation of tissue blood flow (1CPMTBF = ACF/SD), the second component of the passive mechanism of modulation of tissue blood flow (2CPMTBF = AHF/SD); index parameters: intravascular resistance (IR), coefficient of microcirculation efficiency (CME) in areas of lesional skin (area α) and unaffected skin (area β).

Microbiological analysis of the skin microflora from areas α and β was also performed in 91 patients with LP using the contact agar plate method, followed by morphological identification of the microorganisms.

The control group consisted of 30 practically healthy individuals, matched by age and sex.

Statistical processing of the research results was carried out using generally accepted parametric and nonparametric methods of statistical analysis in medical and biological studies on a personal computer using the programs Statistica 6.0 ("Statsoft", USA) and Microsoft Excel. The values of the arithmetic mean (μ), standard deviation (σ), and the error of the mean (m) were determined. The level of significance of differences (p) was calculated using Student's t-test (t). In the case of non-uniform distribution of features, significance was determined using the

nonparametric Mann–Whitney test. To determine the degree of relationship between two indicators, the correlation coefficient (r) was calculated. Positive values of r indicated a direct relationship of indicators, negative values indicated an inverse relationship between them (r equal to up to 0.30 indicated a weak degree of relationship, from 0.31 to 0.50 – a moderate degree of relationship, from 0.51 to 0.70 – a significant degree, and from 0.71 to 1.00 – a high degree of relationship between the studied indicators).

Research results and their discussion

91 patients with LP were examined. Among the probable causes of dermatosis occurrence, the dominant positions were occupied by neuro-psychic factors, bacterial and viral infections, which were noted, respectively, in 31(34.1 %) and 19(20.8 %) patients. Notably, 16(17.6 %) patients could not identify the probable cause of dermatosis development.

Concomitant pathology was detected in 42(46.2 %) patients and was represented by diseases of the gastrointestinal tract (in 13–14.3 %), pathology of peripheral circulation (in 4–4.4 %), and the nervous system (in 3–3.3 %). In 7(11.9 %) women, gynecological diseases were diagnosed. Among other diseases suffered before the onset of LP, the leading positions were occupied by acute respiratory viral infections, which were observed in 88(96.7 %) patients.

Disseminated LP was diagnosed in all observed patients. In 69(75.8 %) patients, a typical form of dermatosis was identified, in 12(13.2 %) – hypertrophic, and in 11(11.0 %) – pigmented. In 58(63.7 %) patients, a progressive stage of the pathological process was verified, and in 33(36.3 %) – a stationary stage. Lesions of the oral mucosa were noted in 18(19.8 %) examined patients with LP.

So, in the examined patients, different clinical forms and stages of LP were diagnosed. The conducted analysis of skin clinical manifestations of LP proves the expediency of studying individual mechanisms of its development, in particular, the states of dermal blood circulation and skin microbiocenosis.

In the study of dermal blood circulation, it was established that in patients with LP, regardless of the clinical form of the dermatosis, suppression of the values of generalizing indicators was observed both in the areas α and β (at a distance of not less than 1–3 cm from the areas of LP rash lesions). At the same time, a decrease in the indicators of the amplitude spectrum of the microcirculatory bed of the skin, in particular MI, reflects insufficiency of tissue perfusion, SD – deterioration of the functioning of the mechanisms of modulation of the microcirculatory bed of the skin, and CV – suppression of vasomotor activity of microvessels. The results of the corresponding studies were presented in Table 1.

Data revealed that in the examined patients, regardless of the clinical form of the pathological process, multidirectional changes in the values of ALF occur in areas α and β. In particular, if in lesional area α its suppression was recorded: in the typical form of the dermatosis to 1.12 ± 0.04 perfusion units (PU), in the hypertrophic form – to 1.17 ± 0.03 PU, and in the pigmented form to 1.14 ± 0.05 PU (in individuals of the control group – 1.28 ± 0.05 PU; $p < 0.05$), then in unaffected area β, on the contrary, an increase was noted, respectively, to 1.46 ± 0.6 PU, 1.52 ± 0.08 PU and 1.43 ± 0.04 PU ($p < 0.05$). The values of the amplitude of fast oscillations (AHF) and the amplitude of pulse oscillations (ACF) decreased, regardless of the clinical forms of the disease ($p < 0.05$), both in areas α and β.

It was established that in the examined patients with LP, regardless of the clinical form of the pathological process, physiological values of the first component of the active mechanism of modulation of tissue blood flow (1CAMTBF) and the second component of the active mechanism of modulation of tissue blood flow (2CAMTBF) were registered in area α, in contrast to area β, where an increase in the level of 1CAMTBF was noted, which was associated with a decrease in the levels of 2CAMTBF. The activity of both 1CAMTBF and 2CAMTBF was recorded in a suppressed state ($p < 0.03$) in both areas of examination. As for intravascular resistance (IR), its physiological content was stated in lesional area α and an increase in unaffected area β. The increase in the levels of CME in both areas of the study deserves attention. These processes were independent of the clinical form of the dermatosis.

Since ALF reflects the endothelial activity of capillaries, precapillary sphincters and juxtacapillary ("shunting") blood flow, AHF – blood stasis in venules, ACF – vasodilation processes in the microcirculatory bed of the skin, 1CAMTBF and 2CAMTBF – respectively myogenic and neurogenic potentials, 1CPMTBF – cardiac, and 2CPMTBF – respiratory rhythms of fluctuations. IR reflects rheological properties, and CME makes it possible to volumetrically assess the ratio of active and

Table 1

Generalizing indicators of the state of the microcirculatory bed of the skin depending on the clinical form of lichen planus

Groups of examined patients	LDF examination areas	MI (M ± m), Perfusion Units	SD (M ± m), Perfusion Units	CV (M ± m), Perfusion Units
Patients with typical form of LP (n = 69)	α	4.05 ± 0.13*	0.61 ± 0.03*	15.21 ± 0.17*
	β	3.98 ± 0.15*	0.57 ± 0.04*	14.98 ± 0.16*
Patients with hypertrophic form of LP (n = 12)	α	4.12 ± 0.09*	0.63 ± 0.04*	15.35 ± 0.15*
	β	4.16 ± 0.13*	0.56 ± 0.05*	15.04 ± 0.15*
Patients with pigmented form of LP (n = 10)	α	3.98 ± 0.08*	0.59 ± 0.06*	15.07 ± 0.18*
	β	4.24 ± 0.17*	0.55 ± 0.06*	15.02 ± 0.14*
Control group (n = 30)	Unaffected skin	4.98 ± 0.15	0.79 ± 0.06	16.41 ± 0.14

Note: * – significant difference from the values of the corresponding indicator in individuals of the control group ($p < 0.05$).

passive modulation of blood flow, the obtained results demonstrate that, regardless of the clinical form of the dermatosis, in area α – a stagnant-stasis type, and in area β – a spastic type of blood flow was recorded.

Observations showed that in the examined patients with LP, regardless of the clinical stage of the pathological process, a decrease in the values of generalizing indicators was recorded both in areas α and β. This indicates insufficiency of tissue perfusion, functioning of the mechanisms of dermal blood circulation and vasomotor activity of microvessels. It was established that in patients with LP, regardless of the clinical stage of the dermatosis, multidirectional changes in ALF values were noted both in areas α and β. In particular, if in the progressive stage of the disease, its decrease to 1.09 ± 0.07 PU was stated (in the control group – 1.28 ± 0.05 PU; $p < 0.05$), then in the stationary stage, on the contrary, an increase to 1.40 ± 0.02 PU ($p < 0.05$). In area β, regardless of the clinical course of the dermatosis, an increase in ALF values was observed, respectively, to 1.53 ± 0.10 PU ($p < 0.05$) and 1.45 ± 0.04 PU ($p < 0.05$). The values of AHF and ACF were read, regardless of the clinical stage of the disease, in both areas of the study.

The dependence of the levels of 1CAMTBF and 2CAMTBF on the clinical stage of the dermatosis was recorded in patients with LP. Thus, if both indicators retained control values in the progressive course of the disease in area α, respectively, 0.24 ± 0.02 % (in individuals of the control group – 0.26 ± 0.03 %; $p > 0.05$) and 0.65 ± 0.05 % (in individuals of the control group – 0.68 ± 0.04 %; $p > 0.05$), then in area β 1CAMTBF increased to 0.38 ± 0.04 % ($p < 0.05$), and 2CAMTBF decreased to 0.040 ± 0.03 % ($p < 0.05$). In patients with the stationary stage of the dermatosis, the levels of 1CAMTBF in both areas of examination increased ($p < 0.05$), and 2CAMTBF decreased ($p < 0.05$). The activity of both 1CPMTBF and 2CPMTBF ($p < 0.05$) was recorded in a suppressed state, regardless of the course of the dermatosis.

It was stated that in patients with the progressive stage of LP, the preservation of control values of IR in area α – 3.72 ± 0.15 % (in individuals of the control group – 3.68 ± 0.09 % ($p > 0.05$)) and their increase in area β – 4.08 ± 0.17 % ($p < 0.05$) occur. In patients with the stationary stage of the dermatosis, an increase in the levels of the indicator in both areas was observed, respectively, to 3.97 ± 0.10 % ($p < 0.05$) and 4.02 ± 0.08 % ($p < 0.05$). An increase in CME values was recorded regardless of the stage of the pathological process and the area of study.

Thus, the obtained results of the values of generalizing indicators (MI, SD, CV), amplitude spectrum (ALF, AHF, ACF), components of the mechanisms of modulation of dermal tissue blood flow (1CAMTBF, 2CAMTBF, 1CPMTBF and 2CPMTBF), index parameters (IR and CME) of the microcirculatory bed of the skin make it possible to verify in patients with typical, hypertrophic and pigmented forms of LP, with the progressive stage of the dermatosis, a stagnant-stasis type of blood flow – in area α and a spastic type – in area β. In patients with the stationary stage of the pathological process, in areas both α and β, a spastic type of hemodynamics was identified. In individuals of the control group, a normotonic type of blood flow was observed. The obtained results of the corresponding studies require consideration in the development of optimized treatment management for patients with LP.

We also conducted a study of the state of the skin microbiocenosis in the examined patients with LP. Before the study, topical corticosteroids, local antiseptics and antifungal agents, as well as systemic antibiotics, were not used for three days.

According to the results of the conducted studies in individuals of the control group and in the examined patients with LP, a taxonomic composition of microorganisms was identified, which consisted mainly of *S. pyogenes, S. epidermidis, S. saprophyticus, S. aureus, E. coli* and "other species". Since representatives of the genera *Micrococcus*, *Bacillus*, *Sarcina*, *Acinetobacter* and other genera were very rarely encountered; therefore, they were grouped "other species". It was shown that in individuals of the control group the following were isolated: *S. aureus* – in 2(6.7 %) individuals, *E. coli* – in 2(6.7 %), *S. epidermidis* – in 3(10.0 %), *S. pyogenes* – in 4(13.3 %), *S. saprophyticus* – in 11(36.6 %), "other species" – in 8(26.7 %). It should be noted that among them, in 2(6.7 %) an association of *S. aureus* and *S. saprophyticus* was isolated, in 2(6.7 %) – *E. coli* and *S. saprophyticus*, and in 2(6.7 %) – *S. pyogenes* and "other species". Thus, the examined individuals of the control group demonstrated a monomicrobial skin colonization pattern.

A completely different picture was observed in patients with LP. In particular, in patients with the typical form of the dermatosis, the following associations were isolated from area α: *S. aureus*, *S. pyogenes* and *S. epidermidis* – in 25(36.2 %) individuals, *S. aureus*, "other species" and *S. saprophyticus* – in 15(21.7 %), *S. aureus, S. pyogenes, E. coli and S. epidermidis* – in 24(34.8 %), *E. coli* and *S. saprophyticus* – in 2(2.9 %). And only in 3(4 %) individuals *S. epidermidis* was isolated as a monomicrobial agent. Thus, patients with the typical form of LP were characterized by polymicrobial colonization of area α. The spectrum of the microbial landscape narrowed during microbiological examination of area β. The following combinations were recorded: *S. aureus* and *S. epidermidis* – in 26(37.7 %) individuals, *S. pyogenes* and *S. saprophyticus* – in 24(34.8 %), "other species" and *S. saprophyticus* – in 13(18.8 %) individuals. And only in 4(5.8 %) individuals *S. epidermidis* was isolated, and in 2(2.9 %) – *E. coli* as the only representatives of the skin microflora. Thus, patients with the typical form of LP were characterized by dual-species colonization of area β. It should be noted the excessive increase in the detected microorganisms in both areas of examination in this category of patients ($p < 0.05$).

In patients with the hypertrophic form of LP in area α, the following associations were registered: *S. aureus* and *S. saprophyticus* – in 3(25.0 %) individuals, "other species" and *S. saprophyticus* – in 3(25.0 %), *S. pyogenes* and *S. saprophyticus* – in 3(25.0 %), *S. epidermidis* and *E. coli* – in 3(25 %). Similar results were obtained for area β. Thus, in this category of patients, dual-species colonization of both areas α and β was noted. Also, in these patients, an increased number of isolated microorganisms ($p < 0.05$) was observed in both areas of the study.

It was shown that in patients with the pigmented form of LP in area α, the following combinations were recorded:

S. aureus and *S. saprophyticus* – in 2(20.0 %) individuals, "other species" and *S. saprophyticus* – in 3(30.0 %), *S. pyogenes* and *S. saprophyticus* – in 3(30.0 %), *S. epidermidis* and *E. coli* – in 2(20.0 %). Similar results were also obtained in area β. In this group of patients, dual-species colonization was observed both in areas α and β. Also, an excessive number of detected microorganisms ($p < 0.05$) was noted in these patients in both areas of examination.

In patients with the progressive stage of LP in area α, the following associations appear: *S. aureus*, *S. pyogenes* and *S. epidermidis* – in 22(37.9 %) individuals, *S. aureus*, "other species" and *S. saprophyticus* – in 15(25.8 %), *S. aureus*, *E. coli* and *S. saprophyticus* – in 6(10.4 %). And only in 3(5.2 %) individuals *S. epidermidis* was isolated as a single-species colonization. Thus, patients with the progressive stage of LP were characterized by polymicrobial colonization of area α. In area β, during microbiological examination, a narrowing of the spectrum of the microbial landscape of the skin was recorded. In particular, the following combinations were identified: *S. aureus* and *S. epidermidis* – in 19(32.8 %) individuals, *S. pyogenes* and *S. saprophyticus* – in 18(31.0 %), "other species" and *S. saprophyticus* – in 15(25.9 %), *S. epidermidis* and *E. coli* – in 6(10.3 %). In patients with the progressive stage of LP, dual-species colonization of area β was observed. Also, in these patients, an increased number of detected microorganisms was distinguished in both areas of examination.

It was established that in patients with the stationary stage of LP in area α, the following combinations were registered: *S. aureus* and *S. saprophyticus* – in 11(33.3 %) individuals, "other species" and *S. saprophyticus* – in 9(27.3 %), *S. pyogenes* and *S. saprophyticus* – in 7(21.2 %), *S. epidermidis* and *E. coli* – in 6(18.2 %). Comparable results were obtained in area β. The patients with the stationary stage of LP were characterized by dual-species colonization of both areas α and β. Attention was also required by the increased number of detected microorganisms in both areas of the study.

The control group showed a polymicrobial skin microbiocenosis composed of several bacterial species, including *S. aureus*, *S. pyogenes*, *S. epidermidis*, *S. saprophyticus*, and *E. Coli, "other species", which were isolated as* monomicrobial pathogens. A different picture was diagnosed in patients with LP; in particular, in patients with the typical form of the dermatosis in areas α, polymicrobial colonization occurs, which consists of associations of three or more of these microbial agents. Area β was characterized by a narrowing of the spectrum of microbial combinations to two components, that is, the development of dual-species colonization. Similar results were also obtained in patients with the progressive stage of the disease. A more problematic type of infection was identified in patients with hypertrophic and pigmented forms and the stationary stage of LP in both areas of the study. In addition, in the examined patients with LP, an increase in the microbial colonization of detected microorganisms was noted, which does not depend on the form of the dermatosis, the stage of the pathological process and the areas of skin examination.

The analysis of the studies conducted by us in patients with LP with different clinical forms of this dermatosis (typical, hypertrophic, pigmented) indicates the presence of a moderate degree of relationship between the state of dermal vascularization and skin microbiocenosis, which ranges from $r_1 = +0.32$ to $r_4 = +0.41$. A similar degree of relationship between the state of dermal blood circulation and skin microbiocenosis was also found in patients with progressive and stationary stages of the course of this dermatosis, which ranges from $r_7 = +0.31$ to $r_{10} = +0.44$.

Thus, the identified features of the skin microbiocenosis and dermal blood circulation in patients with LP indicate their important role in the pathogenesis of this dermatosis, which requires consideration in the development of optimized treatment management.

Conclusions

According to the analysis of the results of studies of the functional state of the dermal microcirculatory bed, in particular the microcirculation index (MI), standard deviation of the microcirculation index (SD), coefficient of variation (CV); amplitude spectrum: amplitude of slow oscillations (ALF), amplitude of pulse oscillations (ACF), amplitude of fast oscillations (AHF); components of the mechanisms of modulation of dermal tissue blood flow: the first component of the active mechanism of modulation of tissue blood flow (1CAMTBF = ALF/MI), the second component of the active mechanism of modulation of tissue blood flow (2CAMTBF = SD/ALF), the first component of the passive mechanism of modulation of tissue blood flow (1CPMTBF = ACF/SD), the second component of the passive mechanism of modulation of tissue blood flow (2CPMTBF = AHF/SD); index parameters: intravascular resistance (IR), coefficient of microcirculation efficiency (CME) in patients with typical, hypertrophic and pigmented forms of LP with the progressive stage of the dermatosis, a stagnant-stasis type of blood flow in the areas of the pathological process and a spastic type of blood flow in the areas of unaffected skin were verified. In patients with the corresponding clinical forms of LP with the stationary stage of the pathological process, a spastic type of hemodynamics was registered both in the areas of the pathological process and in the areas of unaffected skin.

The presence of changes in the skin microbiocenosis in patients with lichen planus was established. In particular, in patients with the typical form of the dermatosis with progressive and stationary stages of the course, polymicrobial colonization in the areas of skin lesions was diagnosed, which was represented by an association of three or more different microbial agents, and in the areas of unaffected skin, a narrowing of the spectrum of combinations of microorganisms to two components (dual-species colonization) was observed. A dual-species colonization of the skin was also detected in both lesional and unaffected areas in patients with hypertrophic and pigmented forms of LP with progressive and stationary stages of the course. In addition, in the examined patients with lichen planus, excessive bacterial load of the detected microorganisms was diagnosed, regardless of the clinical form of the dermatosis, the stage of the pathological process and the areas of skin examination.

Our findings indicate that in patients with different clinical forms of LP (typical, hypertrophic, pigmented), with

different stages of the course (progressive, stationary), a moderate degree of association between disturbances of the state of dermal blood circulation and skin microbiocenosis was observed.

Prospects for further research. Future research will focus on developing an improved, pathogenetically substantiated complex therapy for LP, aimed at individualized therapeutic correction of individual trigger factors significant in the manifestation of the dermatosis, in particular disorders of dermal blood circulation and skin microbiocenosis, which will contribute to increasing the effectiveness of treatment.

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