2. Kamosko MM, Poznovich MS. Konservativnoyelecheniyedisplaziitazobedrennykhsustavov. Ortopediya, travmatologiya i vosstanovitelnayakhirurgiyadetskogovozrasta. 2014; 2(4): 51-60. [inRussian]

3. Korolkov OI, Onischenko OV, vynakhidnyky, patentovlasnyky; Sposibkonservatyvnoholikuvannyadysplaziyikulshovohosuhloba u ditey. PatentUkrayiny № 111924. 2016 lys 25. [in Ukrainian]

4. Korolkov OI, vynakhidnyk, patentovlasnyk; Sposibmodelyuvannyakulshovohosuhloba. PatentUkrayiny № 31078. 2008 ber 25. [in Ukrainian]

5. Pozdnikin IYu, Baskov VE, Voloshin SYu, Barsukov AI, Krasnov AI, Poznovich MS, i dr. Oshibkidiagnostiki i nachalakonservativnogolecheniyadetey s vrozhdennymvyvikhombedra. Ortopediya, travmatologiya i vosstanovitel'nayakhirurgiyadetskogovozrasta. 2017; 5(2): 42-51. [inRussian]

6. Tyazhelov AA, Filipenko VA, Yaresko OV, Bondarenko SYe. Matematychnamodeltazadlyarozrakhunkuyoho napruzheno-deformovanoho stanu. Ortopediya, travmatolohiya i protezuvannya. 2015; 1: 25-33. [in Ukrainian]

7. Klit J, Gosvig K, Jacobsen S, Sonne-Holm S, Troelsen A. ThePrevalenceofPredisposingDeformityinOsteoarthriticHipJoints. HipInt. 2011 Sep-Oct; 21(5): 537-41. DOI: 10.5301/HIP.2011.8678

8. Kurowski P. Engineering Analysis with SolidWorks Simulation 2012. 2012. 475p. ISBN: 978-1-58503-710-0.

9 . RuimermanR. Modeling and remodeling in bone tissue.Eindhoven: TechnischeUniversiteitEindhoven; 2005. 109p. DOI: 10.6100/IR583545

10. Shen M et al. Finite element modelling of 10-year-old child pelvis and lower extremities with growth plates for pedestrian protection. Int. J. Vehicle Safety. 2015; 8(3): 263-85.

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THERAPEUTIC POTENTIAL OF LACTOBACILLI-BASED DRUG IN THE TREATMENT OF GENERALIZED PERIODONTITIS

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The article presented the study results on the method of generalized periodontitis treatment with lactobacilli-based probiotic drug. Its efficacy was accessed according to generally accepted clinical and microbiological studies in the treatment dynamics in patients with stages I and II of generalized, chronic periodontitis on the 1st, 5th and 10th day of follow-up. Treatment of periodontitis included professional oral hygiene, topical and common application of probiotics. Probiotic application for the treatment of generalized periodontitis contributed to the improvement of oral health ($p<0.001$), as well as a significant reduction in symptomatic manifestation of gingivitis ($p <0.001$). The results of microbiological studies showed a decrease in the total count of colony-forming units in gingival pockets on Day 10 of treatment ($p<0.05$), as well as an increase in stabilizing bacterial species.

Key words: generalized periodontitis, probiotic, lactobacilli, microflora of gingival pockets.

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МОЖЛИВОСТІ ЗАСТОСУВАННЯ ПРЕПАРАТУ НА ОСНОВІ ЛАКТОБАЦИЛ У ЛІКУВАННІ ГЕНЕРАЛІЗОВАНОГО ПАРОДОНТИТУ

В статті наведені результати вивчення способу лікування генералізованого пародонтиту із використанням пробіотика, виготовленого на основі лактобацил. Ефективність оцінювали за даними загальноприйнятих клінічних та мікробіологічних досліджень в динаміці лікування пацієнтів із хронічним генералізованим пародонтитом I та II ступеню тяжкості на 1, 5 та 10 добу спостережень. Лікування пародонтиту включало професійну гігієну ротової порожнини, місцеве та загальне застосування пробіотика. Застосування пробіотика для лікування генералізованого пародонтиту сприяло покращенню стану гігієни порожнини рота ($p<0,001$), а також значному зменшенню явищ симптоматичного гінгівіту ($p<0,001$). Результати мікробіологічних досліджень показали зменшення загальної кількості колонієутворюючих одиниць у пародонтальних кишенях на 10 добу лікування ($p<0,05$), а також збільшення стабілізуючих видів мікроорганізмів.

Ключові слова: генералізований пародонтит, пробіотик, лактобацили, мікрофлора пародонтальних кишень.

The work is a fragment of the research project "Study of the role of opportunistic and pathogenic infectious agents with different sensitivity to antimicrobial and antiviral drugs in human pathology", state registration No. 0118U004456.

The importance of finding new ways to treat periodontal disease is determined by the fact that the number of people suffering from generalized periodontitis is growing steadily and this pathology is losing its age restrictions. The reason for this situation is the deterioration of environmental, demographic, and social factors, which leads to the immune system disorders and causes a depression of the protective barriers of the oral mucosa (OM). Decreased colony-forming resistance of OM, imbalance of the resident microflora in the oral ecosystem contributes to the development of generalized, chronic periodontitis [1].

To date, probiotic drugs are considered the most promising drugs against antibiotic-resistant subpopulations of pathogenic bacteria [3]. According to the WHO (2002), probiotics are living microorganisms, the use of which in the required amount provides therapeutic and preventive care for the

human body. They include various strains of normal microflora with high antagonistic, enzymatic and immunomodulatory properties that can inhibit the growth of pathogenic bacteria [10].

Lactobacilli-based probiotics are most often used to correct dysbiosis in the mucous membranes of the human body, in particular in the oral cavity [2, 9]. The effectiveness of the drug based on Lactobacillus acidophilus and low-level laser therapy in the treatment of generalized, chronic periodontitis has been confirmed based on microbiological and clinical studies [11]. Based on biochemical studies, the effectiveness of the use of multiprobiotics based on lactobacilli, bifidobacteria, propionic acid bacteria and lactococci in patients with chronic generalized periodontitis has been proven [5]. A method of treating catarrhal gingivitis in children using a drug containing 10^8 colony-forming units of Lactobacillus reuteri has been proposed [10]. Based on microbiological studies, the positive effect of the probiotic inclusion based on Lactobacillus rhamnosus and Lactobacillus helveticus in children in the complex of therapeutic agents for chronic catarrhal gingivitis has been confirmed [7].

Most modern probiotics contain live forms of lactic acid bacteria. Lactic acid bacteria of the genus Lactobacillus are present in the human digestive tract and are part of the natural ecological barrier. Lactobacilli maintain the balance of intestinal microflora, prevent the increase in the pathogenic and putrefactive microbial count in the intestine, the formation and exposure to certain intracellular toxins. They synthesize bacteriocins that inhibit the growth of a wide range of pathogenic and opportunistic bacteria, but do not affect the beneficial bacteria of the normal microflora. Lactic acid bacteria produce hydrogen peroxide, activate macrophages and promote the production of the immunoglobulin G (IgG2) subclass, thereby stimulating the immune processes. They promote the synthesis of some B-vitamins (B1, B2, B6, B12, niacin, folic acid, pantothenic acid), have a positive effect on intestinal motility, improve protein digestion and promote the lactose breakdown into glucose and galactose. They also promote lactic acid production; inhibit the activity of nitroreductase, azoreductase and beta-glucuronidase, thereby reducing the production of carcinogenic amines [1].

Despite numerous scientific studies, we have not found data on the use of a drug containing Lactobacillus acidophilus and Lactobacillus rhamnosus in periodontal practice.

The purpose of the study was to study the effectiveness of a probiotic based on lactobacilli in the complex treatment of patients with generalized, chronic periodontitis of varying severity.

Materials and methods. According to the purpose of the study, clinical, paraclinical and microbiological studies were performed in 28 patients with generalized, chronic periodontitis (GP) of I and II degrees of severity aged 40 to 55 years. The Schiller-Pisarev test, PMA gingival index modified by C. Parma, and the Mühlemann Papillary Bleeding Index were determined. The state of oral health was accessed according to the Fedorov-Volodkina and Green-Vermillion indices. The bone tissue condition of the alveolar processes was determined by orthopantomography.

The contents of periodontal pockets were sampled with a sterile 1 cm long paper point no. 25, which was placed in eppendorf with 1 ml of sterile saline solution. Inoculation by the Gold method was performed with a bacterial inoculating loop on the surface of 5% blood agar. Petri dishes were placed in a thermostat at 37° C for two days. Microbial count was estimated using the Gold table, colony-formation density was determined in lg CFU/ml.

To isolate colonies of facultative anaerobic bacteria: streptococci, staphylococci, neisseria and yeast-like fungi, cultures of eppendorf content were inoculated on blood agar, Egg-yolk Salt Agar Base, Sabouraud agar medium. After 24-48 hours of incubation at 37 °C, the density of bacterial community was calculated in 1 mg of material (CFU/mg) in accordance with the Order of the Ministry of Health of the USSR No. 535 of 22.04.1985 [6].

Determination of CFU of anaerobic bacteria, among which the main periodontal pathogenic gram-negative rods of the genera Bacteroides, Prevotella, Porphyromonas predominated, was performed for 3-5 days after inoculation in sugar agar, using the "Method of isolation of anaerobic bacteria in the oral cavity" [4]. Then we cultivated it for 72 hours and took into account the colonies in the depth of the medium. They were counted using a bacterial colony counting device (PKB IN 10470826). Isolates were identified according to the Bergey's Manual (1997).

Treatment of patients with periodontitis included professional hygiene and sanation of the oral cavity, topical and common application of the probiotic drug "Lacidofil forte", containing lactobacilli Lactobacillus acidophilus and Lactobacillus rhamnosus, (Lallemand Health Solutions Inc., Canada).

After tooth brushing, the contents of one capsule were dissolved in 20 ml of warm boiled water, resulting solution was carried out in the mouth for 2 minutes, after which the patient swallowed the solution. This procedure was performed once a day for 10 days.

The treatment effectiveness was accessed according to the main and additional studies on 1st, 5th and 10th days of treatment. The same number of patients with generalized periodontitis who received topically applied "NBF Gingival Gel" (NanoCureTech Inc, South Korea) for 10 days after professional oral hygiene and sanitation was selected as a comparison group.

Statistical processing was performed using Microsoft Excel Office 2010. The reliability of the data was analyzed using Student's t-test.

Results of the study and their discussion. During the examination of patients with generalized, chronic periodontitis, it was found that all patients complained of bleeding gums, mobility of teeth, exposure of roots, bas smell. Periodontal status was characterized by congestive hyperemia of the gums, the presence of supragingival and subgingival dental deposits, periodontal pockets up to 5 mm, teeth mobility and gums recession of I-III types. According to orthopantomography, uneven resorption of bone tissue of alveolar processes up to 1/3-1/2 length was established.

In the group of examined patients with GP of I and II degrees of severity of both groups, unsatisfactory oral health according to the Fedorov-Volodkina index (2.3±0.7 scores) and satisfactory hygiene according to the Green-Vermilion index were established (1.4±0.56 scores). The mean prevalence of gingivitis according to PMA gingival index was 33.6±16%. Mühlemann Papillary Bleeding Index (PBI) was 1.38±0.42 scores.

After a 10-day course of treatment with "Lacidofil forte" in all examined patients, according to subjective and objective examination, the symptomatic manifestation gingivitis disappeared, as well as oral health had been improved. In all patients of the main group, the Fedorov-Volodkina HI decreased by 1.91 times and amounted to 1.2±0.13 scores ($p<0.001$), and the Green-Vermilion HI decreased by 7 times (0.2±0.18 scores, $p<0.001$).

The anti-inflammatory effect of the treatment course with "Lacidofil forte" in all patients with GP of I and II degrees of severity was confirmed by a significant decrease in the PMA index by 3.6 times ($p<0.001$), and the Mühlemann Papillary Bleeding Index decreased by 3.4 times ($p<0.001$)

After a treatment course with the drug "NBF Gingival Gel" in patients of the comparison group also improved oral hygiene and decreased the degree of gingivitis. Thus, the Fedorov-Volodkina HI decreased by 1.93 times ($p<0.001$), and the Green-Vermilion HI decreased only by 2.17 times ($p<0.05$), which indicated a higher level of correction of the oral cavity hygiene in patients with GP who underwent treatment with "Lacidofil forte".

The degree of gingivitis after treatment in the comparison group decreased by the PMA index by 6.4 times ($p<0.001$), and by the Mühlemann Papillary Bleeding Index – by 2.2 times ($p <0.001$), which can be explained by a more pronounced anti-inflammatory effect of the components of "NBF Gingival Gel" (table 1).

Table 1

Dynamics of oral cavity index parameters in patients of experimental groups (M±m)

Index parameters	Study group (14)			Comparison group (14)	
	Before treatment	Day 5	Day 10	Before treatment	After treatment
Fedorov-Volodkina HI, scores	2.3±0.7	1.6±0.4	1.2±0.13 p<0.001	1.95±0.28	1.01±0.05 p<0.001
Green-Vermillion HI, scores	1.4±0.56	0.4±0.31	0.2±0.18 p<0.001	1.37±0.23	0.63±0.17* p<0.05
PMA index, %	33.6±16	17.6±8.3	9.2±9.6 p<0.001	32.0±2.03	5.0±1.12 p<0.001
PBI, scores	1.37±0.42	0.87±0.27 p<0.001	0.4±0.24 p<0.001	1.94±0.26	0.86±0.08* p<0.001

Notes: in ( ) – the number of people examined; – the probability criterion compared to the indicator before treatment; * – a significant difference (P0.05) compared to the same indicator of the experimental group.

According to microbiological studies, there was a tendency in patients of the experimental group to increase the total microbial count in periodontal pockets almost twice on the 5th day, but on the 10th day there was a probable decrease in the bacteria CFU slightly higher compared to the initial results. According to microbiological studies of Gold inoculation method, colonization of the periodontal pocket microflora in patients with GP before treatment was 7.65±0.97 Ig CFU/ml, on the 5th day of treatment – 7.78±0.37 Ig CFU/ml, and on the 10th day of treatment it decreased to 6.71±0.76 Ig CFU/ml.

When counting the colonies of facultative anaerobic bacteria that grew after inoculation by the typical method, there was a tendency to increase the total microbial count on the 5th day of treatment by 1.94 times ($p<0.05$), but on the 10th day there was a significant decrease in bacteria CFU by 2.22 times ($p<0.05$).

The largest number of bacteria 11.61±2.67 CFU/mg $x10^7$ was isolated from periodontal pockets of patients with GP by the method for isolation of anaerobic bacteria. At the same time on the 5th day of treatment, the total count of anaerobes' CFUs was significantly reduced by 1.46 times and significantly decreased on the 10th day by 2.78 times ($p<0.05$) compared with initial results (table 2).

Table 2

Total bacterial count of periodontal pockets, (M±m)

Inoculation methods	Before treatment (n=14)	In 5 days (n=14)	In 10 days (n=14)
Gold method, lg CFU/ml	7.65±0.97	7.78±0.37	6.71±0.76
Typical method, CFU/mg x 10^7	2.58±0.19	5.01±0.32 ($p<0.05$)	2.26±0.27 ($p<0.05$)
Method of anaerobic bacteria isolation, CFU/mg x 10^7	11.61±2.67	7.94±2.07	4.17±0.89 ($p<0.05$)

The qualitative composition of the periodontal pocket's microflora also varied significantly from mainly gram-negative representatives and gram-positive cocci to gram-positive, rod-shaped, bacteria. During the morphological study of bacteria, it was found that at the first visit there was a prevalence of gram-negative microflora, on the 5th day of treatment there was an equal amount of saprophytes and gram-negative microflora, and on the 10th day saprophytic microflora prevailed. Therefore, with the topical application of probiotic "Lacidofil forte" there was a restoration of the normal microflora of the oral cavity, so this drug can be used in the complex treatment of generalized, chronic periodontitis of varying severity.

Thus, our study confirmed that in generalized periodontitis there are dysbiosis in the microbiome of the oral cavity. The identified changes indicated a decrease in the antagonism of symbiotic bacteria to pathogenic and potentially pathogenic bacteria in patients with periodontitis. This promotes the growth of pathogenic and potentially pathogenic biofilm bacteria, their vegetation in periodontal pockets and the development of the inflammatory process in periodontal tissues. To correct dysbiotic changes and for the formation of a healthy microbiota, we used a probiotic drug containing stabilizing bacterial species. Lactobacilli included in its composition have the ability to inhibit the growth of pathogenic bacteria and have a favorable safety profile [12]. Due to the active colonization of the oral cavity with lactobacilli, which are gram-positive rods, there was an increase in the total microbial count on the 5th day of treatment and, accordingly, their number increased on the 10th day of the treatment of patients with probiotics. Some studies indicate the anti-inflammatory properties of lactobacilli [14], their immunomodulatory role and their ability to produce bacteriocins that inhibit the growth of a wide range of oral pathogens [15]. The decrease in dysbiotic phenomena that we have identified may be related to the ability of Lactobacillus to have high adhesion to the oral mucosa, enhance the commensal microbiota, and prevent colonization by pathogens. According to our data, the used probiotic drug had a positive effect not only on oral pathogens, but also on clinical parameters, in particular, on the state of oral health, the degree of inflammation, bleeding, swelling and hyperemia of the gums, which is fully consistent with the data of foreign researchers [13].

Conclusions

1. Application of lactobacilli-based drug in the treatment of patients with generalized periodontitis helps to reduce the symptomatic manifestation of gingivitis.

2. After carrying out a course of treatment with the use of immunobiological drug in the contents of periodontal pockets increases the number of stabilizing bacterial species.

3. Probiotic drug "Lacidofil forte" can be used for topical treatment in the treatment of generalized, chronic periodontitis and at the stage of supportive treatment.

References

1. Hodovanets OI, Moroz AV, Popesku DH. Zastosuvannia probiotykiv u stomatolohiyi. Klinichna ta eksperymentalna patolohiyia. 2017; KhUI 1 (59):164-167. [in Ukrainian]

2. Kovach IV, Krupei VIa. Mikrobiotsenoz porozhnyny rota v dynamitsi likuvannia kariyesu zubiv i khronichnoho kataralnoho hinhivitu v ditey iz zakhvoriuvanniamy shlunkovo-kyshkovoho traktu. Sovremennaia stomatolohyia. 2014; 3:50-53. [in Ukrainian]

3. Korotkykh OO, Kalinichenko SV, Dubina NV. Kharakterystyka biolohichnykh vlastyvostey laktobatsyl za aerobhykh ta mikroaerofilnykh umov atmosfery inkubatsiyi. Visnyk problem biolohiyi i medytsyny. 2017; 2 (138), 3:29-32. [in Ukrainian]

4. Loban HA, Hancho OV, Chereda VV, vynakhidnyky; Ukrainska medychna stomatolohichna akademiia, patentovlasnyk. Sposib vydilennia anaerobnykh mikroorhanizmiv rotovoyi porozhnyny. Patent Ukrainy № 62889. 2011 Ver 9. [in Ukrainian]

5. Mykytenko AO, Manko AM, Neporada KS Mozhlyvosti vykorystannia multyprobiotyka „Symbiter-omeha" v likuvanni khronichnoho heneralizovanoho parodontyta. Visnyk problem biolohii i medytsyny. 2013; 2 (102), 3:122-125. [in Ukrainian]

6. Nakaz MOZ Ukrayiny za №167 vid 05.04.2007 Pro zatverdzhennya metodychnykh vkazivok "Vyznachennya chutlyvosti mikroorhanizmiv do antybakterialnykh preparativ" [Internet]. Dostupno na: http://www.moz.gov.ua. [in Ukrainian]

7. Polishchuk TV. Klinichna efektyvnist kompleksu pre- ta probiotyku u likuvanni khronichnoho heneralizovanoho kataralnoho hinhivitu u ditey. Aktualni problemy suchasnoyi medytsyny: Visnyk VDNZU „Ukrayinska medychna stomatolohichna akademiia". 2013; 13, 2 (42):52-56. [in Ukrainian]

8. Savichuk NO, Trubka IA, Marchenko OA. Korrektsiya mikroekologicheskih narusheniy kak sostavlyayushchaya lechebno-profilakticheskikh meropriyatiy u detey s khronicheskim generalizovannym kataralnym gingivitom. Stomatologiya. Estetika. Innovatsii [Internet]. 2017; 1: 87-95. Dostupno: https://rucont.ru/efd/620345. [in Russian]

9. Skripnikova TP, Stupak EP, Levickiy AP, Nidzelskiy MYa, Dudchenko NA. Disbioz polosti rta: problema i resheniye. Ukrayinskiy zhurnal dermatologiyi, venerologiyi, kosmetologiyi. 2018; 1 (68):42-48. [in Russian]

10. Stepanova SV, Fesenko VI. Kompleksnyi podkhod v lechenii yazvenno-nekroticheskikh protsessov SOPR i vospalitelnykh zabolevaniy parodonta. Ukrayinskyi stomatolohichnyi almanakh. 2013; 3:36-37. [in Russian]

11. Chuhrai IG, Andreeva VA Opyt klinicheskogo ispolzovaniya nizkointensivnogo lazernogo izlucheniya krasnogo diapazona spektra i probiotika v kompleksnom lechenii khronicheskogo generalizovannogo parodontita. Ukrayinskyi stomatolohichnyi almanakh. 2013; 5:109-111. [in Russian]
12. Cerbo AD, Palmieri B, Aponte M, Morales-Medina JC, Iannitti T. Mechanisms and therapeutic effectiveness of lactobacilli. J Clin Pathol. 2016 Mar; 69(3): 187–203.
13. Rungsri P, Akkarachaneeyakorn N, Wongsuwanlert M, Piwat S, Nantarakchaikul P, Teanpaisan R. Effect of fermented milk containing Lactobacillus rhamnosus SD11 on oral microbiota of healthy volunteers: A randomized clinical trial. J Dairy Sci. 2017 Oct; 100(10):7780-7787.
14. Van Baarlen P, Troost FJ, van Hemert S, van der Meer C, de Vos WM, de Groot PJ. Differential NF-kappaB pathways induction by Lactobacillus plantarum in the duodenum of healthy humans correlating with immune tolerance. Proc Natl Acad Sci USA.2009; 106:2371–2376.
15. Wannun P, Piwat S, Teanpaisan R. Purification, characterization, and optimum conditions of fermencin SD11, a bacteriocin produced by human orally Lactobacillus fermentum SD11. (26892008) Appl. Biochem. Biotechnol. 2016; 179: 572–582.

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COMPARISON OF CLINICAL AND MORPHOLOGICAL CHANGES IN PERIHEMATOMAL BRAIN TISSUE IN HEMORRHAGIC STROKE

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Pathomorphological research changes in brain tissue in the perihematomal zone of 28 autopsies of patients with hemorrhagic stroke was examinated. It has been established that the combination of acute and chronic lesions of the vascular wall is the cause of premature death in stage I. Coagulation necrosis is a common variant of neuronal death. Hemistocytic astrocytes is significantly predominate in stages II and III. The intensity of regeneration is less pronounced and significantly increases among patients who died after 7 days after the disease. The demarcation inflammation zone in most researches reveals itself in period of early and late subacute hematoma, with the gliomesodermal capsule that forms over time.

Key words: hemorrhagic stroke, demarcation region, "red" neurons, neurons "shadows", hemistocytes, gliomesodermal scar.

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ПАТОМОРФОЛОГІЧНИХ ЗМІН ПЕРИГЕМАТОМНОЇ ТКАНИНИ МОЗКУ ПРИ ГЕМОРАГІЧНИХ ІНСУЛЬТАХ

Досліджено патоморфологічні зміни тканини мозку у перигематомній зоні 28 автопсій пацієнтів з геморагічним інсультом. Встановлено, що поєднання гострих та хронічних уражень судинної стінки є причиною передчасного настання смерті у I стадії. Найчастішим варіантом загибелі нейронів є коагуляційний некроз. Гемістоцитарні астроцити суттєво переважають у II і III стадії. Інтенсивність регенерації менш виражена та істотно зростає у пацієнтів, які померли після 7 дня з моменту захворювання. Зона демаркаційного запалення у більшості досліджень виявляється в період ранньої та пізньої підгострої гематоми, з якої з часом формується гліомезодермальна капсула.

Ключові слова: геморагічний інсульт, демаркаційна зона, «червоні» нейрони, «тіні» нейронів, гемістоцити, гліомезодермальна капсула.

The work is a fragment of the research project "Research of pathomorphological features in diseases of thyroid gland, cardiovascular, digestive, urinary and reproductive systems and perinatal period in order to improve their morphological diagnosis", state registration No. 0118U000100.

Non-intracerebral hemorrhage (NIH) accounts for 10-15% of all acute cerebral circulation disorders [11].

First of all, in early stages (within 24-72 hours), a neurological deficit is expressed and patients serious condition is associated with primary damage to the brain tissue by hematoma, expansion of its area, an increase in perihematoma edema and the spread of blood into the ventricular system [8, 13]. Secondary, brain damage occurs as a result of exposure to thrombin and erythrocyte breakdown (hemoglobin, heme, iron), which have a toxic effect on brain tissue and contribute to the development of inflammation [12,13]. At a later date, in the subacute stage of disease (second - third week), the deterioration of general condition of patients is associated with the formation of an encapsulated hematoma [8]. Therefore, a more detailed morphological research of the perihematomal zone will contribute to the improvement of modern diagnostic methods, as well as surgical and medical treatment of patients with hemorrhagic stroke (HS) in order to prevent mortality and reduce functional deficits in general [4].