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ASSESSMENT OF MICROCIRCULATION IN PATIENTS WITH GENERALIZED PERIODONTITIS DURING TREATMENT WITH AUTOPLASMA AND HYALURONIC ACID

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The relevance of the study of microcirculation is determined by the fact that the nature of its violations can establish the stage of pathological changes in organs and tissues, as well as choose treatment tactics. The aim was to study the dynamics of hemodynamic changes in patients with generalized periodontitis, after treatment with a combined method of plasmagel, i-PRF and hyaluronic acid according to Doppler ultrasound. Diagnosis of microhemodynamic changes in periodontal tissues was performed by ultrasound Doppler. After the treatment it is clear that the improvement of blood flow occurred in both groups, in the main group (after 1 year –1.217±0.035 cm/sec, after 2 years – 1.297±0.061 cm/sec), in the comparison group (after 1 year – 0.729±0.031 cm/sec, after 2 years – 0.632±0.025 cm/sec). In the long run, after 2 years, it can be noted that the indicator in the comparison group gradually begins to decline, and in the main group remains at a high level. Thus, the main group showed a significant increase in linear maximal systolic blood flow velocity (1.297±0.061 cm/sec) and an increase in volumetric maximal systolic blood flow velocity (0.037±0.001 ml/sec).

Key words: periodontal vessels, dopplerography, plasmagel, i-PRF, regenerative techniques.

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ОЦІНКА МІКРОЦИРКУЛЯЦІЇ У ПАЦІЄНТІВ З ГЕНЕРАЛІЗОВАНИМ ПАРОДОНТИТОМ ПРИ ЛІКУВАННІ ПРЕПАРАТАМИ АУТОПЛАЗМИ ТА ГІАЛУРОНОВОЇ КИСЛОТИ

Актуальність дослідження мікроциркуляції визначається тим, що за характером її порушень можна встановити стадію патологічних змін в органах та тканинах, а також обрати тактику лікування. Метою було вивчити динаміку гемодинамічних змін у пацієнтів з генералізованим пародонтитом, після лікування комбінованою методикою препаратів плазмогелю, i-PRF та гіалуронової кислоти за даними ультразвукової доплерографії. Діагностику мікрогемодинамічних змін в тканинах пародонта проводили методом ультразвукової доплерографії. Після проведеного лікування чітко видно, що покращення кровотоку відбулося в обох групах, в основній групі (через 1 рік – 1,217±0,035 см/сек, через 2 роки – 1,297±0,061см/сек), в групі порівняння (через 1 рік – 0,729±0,031 см/сек, через 2 роки – 0,632±0,025 см/сек). На віддаленому терміні, через 2 роки, можна відмітити, що показник в групі порівняння поступово починає знижуватись, а в основній групі лишається так само на високому рівні. Так в основній групі виявило значне посилення лінійної максимальної систолічної швидкості кровотоку (1,297±0,061см/сек) та збільшення об'ємної максимальної систолічної швидкості кровотоку (0,037±0,001 мл/сек).

Ключові слова: судини пародонту, доплерографія, плазмогель, i-PRF, регенеративні методики.

The study is a fragment of the research project "Correction of pathogenetic mechanisms of metabolic disorders in oral tissues in patients depending on environmental and nutritional factors that affect carbohydrate and lipid metabolism", state registration No. 0118U0006966.

Chronic periodontitis is the most common form of inflammatory-dystrophic disease of periodontal tissues. It most often affects adults, although it can occur in children. A characteristic diagnostic sign of this form is the correspondence between the severity of the disease and the severity of local factors associated with the formation of plaques or tartar on the surface of the tooth or roots. It is also characterized by a moderately progressive course with short periods of exacerbation. Periodontitis is a serious medical and social problem. Its significance is determined by a number of events. The prevalence of this pathology among adults remains high and does not tend to decrease [7]. The clinical picture of chronic generalized periodontitis in the early stages of the disease is characterized by a low-manifest and latent course, which complicates timely diagnosis and removes the start of adequate therapeutic and rehabilitation measures [3, 8].

Systemic processes play a significant role in the pathogenesis of generalized periodontitis, in particular, microcirculation disorders that lead to profound changes in the internal environment of the body and, as a consequence, to structural damage to periodontal tissues. Numerous recent studies have shown that changes in the vessels of the microcirculatory tract in periodontitis are very diverse [2]. At the same time, the authors note that both structural and functional changes can occur in vessels: their permeability is disturbed, the number of functioning capillaries decreases, aggregation properties of blood change, which leads to reduced perfusion of the microcirculatory tract with blood [6].

The relevance of the study of microcirculation is determined by the fact that, by the nature of its violations, it is possible to establish the stage of pathological changes in organs and tissues, as well as to choose the tactics of treatment [7, 13].

Today, the search for new drugs and natural bioregulatory substances for targeted tissue regeneration and non-invasive ways of their administration in the treatment of periodontitis is relevant [14]. These include hyaluronic acid gel and autologous platelet- and fibrin-rich plasma (I-PRF) [11].

The most relevant at the moment is the study of the use of injections of hyaluronic acid preparations for the correction/elimination of defects in the gums of the papillae adjacent to the teeth and membranes, to restore the structure and function of the connective tissue [15]. In addition, hyaluronic acid is involved in many biological processes, such as tissue hydration, proteoglycan organization in the extracellular matrix, neovascularization and reinnervation, cell differentiation, their behavior and tissue repair [15].

Autologous platelet plasma preparations are another simple, cheap and minimally invasive way to obtain a natural concentration of autologous growth factors, therefore, exparments are currently being widely conducted in various fields of medicine to determine its ability to promote tissue regeneration with a low potential for healing [5, 10].

The purpose of the study was to clarify the alteration of hemodynamic changes in patients with generalized periodontitis after treatment with a combination of plasma gel, i-PRF and hyaluronic acid according to ultrasound dopplerography.

Materials and methods. This study is based on the analysis of own data obtained as a result of a comprehensive examination of 29 patients aged 36 to 55 years with a diagnosis of generalized periodontitis II-III degree of severity, chronic. The diagnosis was established in accordance with the systematics of periodontal disease N.F. Danilevsky. To assess hemodynamic changes, the patients were divided into 2 groups, 15 patients for comparison and 14 for the main group. Basic therapy was the same in patients of both groups, including the removal of dental deposits, smoothing the surface of the roots with the antiseptic treatment of the oral cavity with a 0.12 % solution of chlorhexidine bigluconate. Biofilm and mineralized dental deposits were removed with a SONICflex sonic instrument (KaVo, Germany), a Prophy Flex hand blaster (KaVo, Germany), using a glycine-based powder – Paro (KaVo, Germany). Smoothing of the root surface was performed using zone-specific Gracie curettes (Hu-Friedy, USA). [13]. In the complex treatment of patients of the 2nd group, in addition to basic therapy, regenerative preparations based on autologous blood plasma and hyaluronic acid (HA) were included. The treatment protocol was: 3 procedures for the introduction of plasmogel into the periodontal pocket with an interval of every 7 days, a single injection of a hyaluronic acid preparation and every 6 months as a preventive therapy injection of i-PRF for 5 procedures with an interval of every 7 days.

Before treatment, all patients were trained in hygienic care of the oral cavity, which included daily 2-fold brushing of teeth using therapeutic and prophylactic hygienic complex: toothpaste GUM "ActiVital" (Sunstar Suisse S.A. Switzerland), toothbrush "Supreme" (TePe, Sweden) as well as brushes for cleaning interdental spaces, selected by size. Control of the results of periodontal treatment was performed before treatment, after 1 year and long-term results were evaluated after 2 years after the course of procedures. In addition, every 6 months, patients of both groups underwent professional hygiene. All patients gave written consent for treatment according to the specified scheme, in accordance with the requirements of the commission on bioethics SE "ISMFS NAMS".

Diagnosis of microhemodynamic changes in periodontal tissues was performed by ultrasound dopplerography (USDG) using a computerized ultrasound Doppler for blood flow studies "Minimax-Doppler-K" model NB (Ltd. "SP-Minimaks", Russia). The research was conducted at the Virtus Institute of Aesthetic Medicine, Odesa, Ukraine.

Quantitative assessment of the dopplerogram was carried out based on the analysis of the forms of the envelope spectrum with the determination of the following indicators.

Linear blood flow velocities (cm/sec):

V_{as} – maximum systolic blood flow velocity on the average velocity curve;

V_{am} – the average linear velocity of blood flow along the average velocity curve;

Volumetric blood flow velocities (ml/sec):

Q_{as} – systolic volumetric velocity on the average velocity curve;

Q_{am} – average volumetric velocity along the average velocity curve;

Acoustic gel contact medium was used to obtain a quality signal. The maximum sound and amplitude signal was obtained by changing the angle of the sensor (≈60°). Diagnosis was performed with a high-frequency ultrasonic sensor 25 MHz to a depth of 5 mm. Studies of hemodynamics of the microcirculatory tract of the parodontium were performed at 6 points in the area of free gums of the masticatory and front teeth of the upper and lower jaws (1.6–1.5, 2.1, 2.5–2.6, 3.6–3.5, 4.1, 4.5–4.6) without pressure on the sensor.

Results of the study and their discussion. According to the results of the analysis of the microcirculatory bed of the periodontium, it was found that in patients with a diagnosis of generalized periodontitis II-III severity, chronic course, microcirculation indicators have low values. Therefore, when examining patients for treatment in the main group, in the comparison group the value of the linear maximum systolic blood flow velocity was 0.398+0.007 cm/s, the volumetric maximum systolic blood flow velocity was 0.014+0.001 ml/min.

Figure 1 shows the dynamics of hemodynamic changes in the maximum systolic blood flow rate 1 and 2 years after the treatment.

The presented diagram shows that the improvement in blood flow occurred after treatment, as in the main group (after 1 year – 1.217±0.035 cm/sec., after 2 years – 1.297±0.061 cm/sec.), as in the comparison group (after 1 year – 0.729±0.031 cm/sec., after 2 years – 0.632±0.025 cm/sec). In the long term, after 2 years, it can be noted that the indicator in the comparison group gradually begins to decline, while in the main group it remains at a high level.

Figure 2 shows the hemodynamic changes in the mean linear velocity of blood flow.

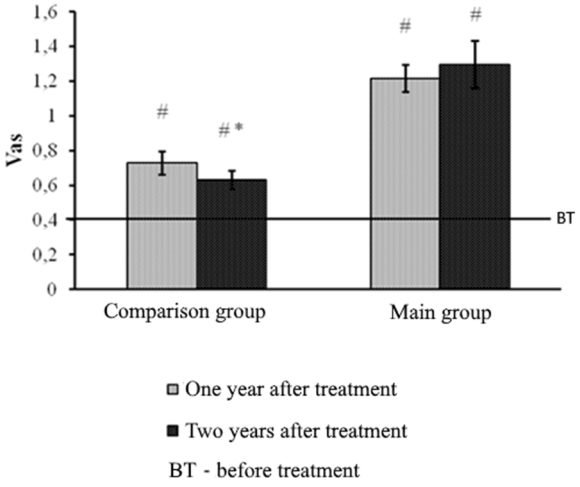

Fig. 1. Linear maximum systolic blood flow velocity $V_{as,}$ cm/sec.

Note: Main group – plasmagel+HA+i-PRF, # – probable discrepancy from indicator before treatment, * – probable discrepancy from the indicator "in a year after treatment", vertical risks – confidence intervals at p=0.05.

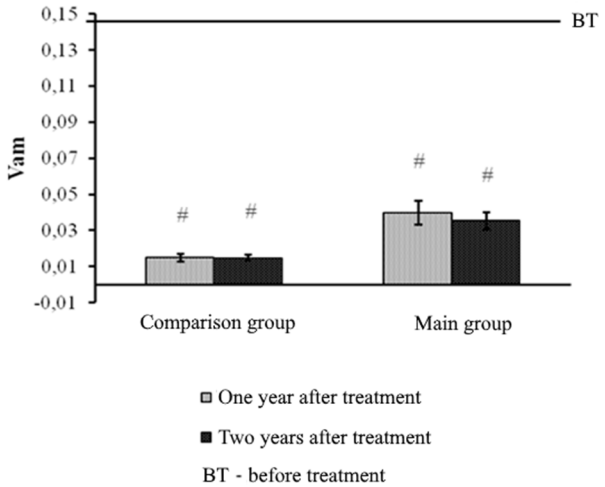

Fig. 2. Average linear velocity of blood flow $V_{am,}$ cm/sec.

Note: Main group – plasmagel+HA+i-PRF, # – probable discrepancy from indicator before treatment, * – probable discrepancy from the indicator "in a year after treatment", vertical risks – confidence intervals at p=0.05.

In the comparison group after treatment, the index increased after 1 year to 0.0151±0.001 cm/sec, after 2 years it remained unchanged at 0.0149±0.008 cm/sec. The indicators of the main group after 1 year were 0.0398±0.0030 cm/sec, after 2 years – 0.0354±0.0021 cm/sec. The results show that there is no significant difference between the indicator at 1 and 2 years of observation. However, there is a probable difference between the indicators of the main group and the comparison group, about 2.5 times increase in the indicator in the main group.

Figure 3 shows the dynamics of volumetric systolic blood flow velocity.

The diagram shows the improvement in blood flow after treatment in both groups. But in the comparison group, the figure after 1 year after treatment is 0.0226±0.0003 ml/sec., and after 2 years – 0.0169±0.0008 ml/sec. In the main group, after 1 year – 0,042±0,001 ml/sec., After 2 years – 0,037±0,001 ml/sec.

The dynamics of the mean volumetric blood flow velocity is shown in figure 4.

At comparison after treatment of groups of comparison and the main probable difference is visible. The index in the comparison group after 1 year – 0.0006±0.0001 ml/sec., after 2 years – 0.0005±0.00001 ml/sec. In the main group, the figure after 1 year was 0.0204±0.0030 ml/sec., and after 2 years – 0.0109±0.0006 ml/sec. This index after treatment in the comparison group has no significant differences from the group of patients before treatment, it also remains at a minimum.

In the analysis of ultrasound spectrograms before treatment, it was found that in all patients there was a significant difference in the average linear and mean volumetric blood flow velocity. Namely, the results of ultrasound dopplerography in patients undergoing treatment demonstrate a moderate change in hemodynamics, which indicates the absence of preservation of compensatory-adaptive mechanisms for regulating tissue blood flow in patients with a diagnosis of generalized periodontitis II-III severity.

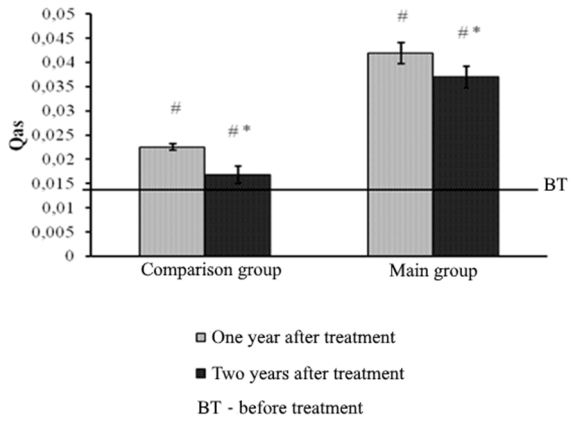

Fig. 3. Volume maximal systolic blood flow rate $Q_{as,}$ ml/sec.

Note: Main group – plasmagel+HA+i-PRF, # – probable discrepancy from indicator before treatment, * – probable discrepancy from the indicator "in a year after treatment", vertical risks – confidence intervals at p=0.05.

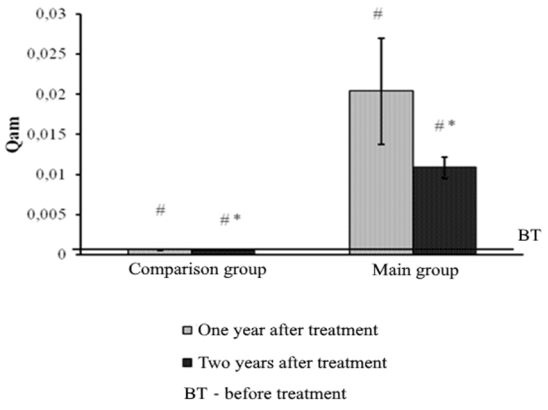

Fig. 4. Average volumetric blood flow velocity Q_{am} ml/sec.

Note: Main group – plasmagel+HA+i-PRF, # – probable discrepancy from indicator before treatment, * – probable discrepancy from the indicator "in a year after treatment", vertical risks – confidence intervals at p=0.05.

Thus, the revealed violations of microcirculation in periodontal tissues in patients with generalized periodontitis indicate a sharp decrease in tissue perfusion with blood, which indicates a deterioration in the trophism of periodontal tissues. The analysis of microcirculation indicators indicated not only a decrease in blood flow intensity, but also a decrease in vasomotor activity of blood vessels, which is extremely important for maintaining the normal functioning of microcirculation, since it provides active modulation of tissue blood flow and its adaptation to local metabolic needs. The decrease in the maximum blood flow velocity in systole is probably associated with spasm of arterioles, venous congestion in the microvasculature, as well as severe periodontal rheological disorders in patients with generalized periodontal disease, a chronic course.

After the treatment, it is clearly seen that the improvement in blood flow occurred in both groups, in the main group (after 1 year – 1.217±0.035 cm/sec, after 2 years – 1.297±0.061 cm/sec), in the comparison group (after 1 year – 0.729 ±0.031 cm/sec, after 2 years – 0.632±0.025 cm/sec). In the long term, after 2 years, it can be noted that the indicator in the comparison group gradually begins to decline, while in the main group it remains at a high level. Thus, in the main group, a significant increase in the linear maximum systolic blood flow velocity (1.297±0.061 cm/sec) and an increase in the volumetric maximum systolic blood flow velocity (0.037±0.001 ml/sec) were revealed.

An analysis of the effectiveness in various modes of use found that in the main group, the positive dynamics is most pronounced, since the treatment protocol, which includes preparations of autologous plasma and hyaluronic acid, not only has a significant effect on the vascular component of the periodontal complex, but also has quite pronounced anti-inflammatory properties due to inclusion in the hyaluronic acid protocol. Although hyaluronic acid itself also has an effect on neoangiogenesis and improves the production of collagen and elastin by fibroblasts, which leads to an improvement in the epithelial attachment of the gums and indirectly affects the prolonged stabilization of the process in long-term results after 2 years.

It has been established that the use of regenerative methods of autoplasma and hyaluronic acid in the tissues of the periodontal complex and a decrease in the manifestations of chronic inflammation of the gums leads to stabilization of hemodynamic parameters.

This suggests that the use of autoplasma and hyaluronic acid in the complex leads to the formation of new vessels in the tissues of the periodontal complex and improves the elasticity of the vascular wall of the microvasculature [12]. A reliable long-term result is maintained by injection every 6 months of the drug i-PRF, to reduce pro-inflammatory activity due to fibronectin, which is part of this plasma preparation, as well as due to platelet growth factors stimulating neoangiogenesis.

One of the leading links in the pathogenesis of generalized periodontitis is a violation of blood microcirculation in periodontal tissues in response to inflammation. Due to their regulatory, metabolic and metabolic functions, microvessels are a kind of indicators that can respond to even minor changes in the gum tissue even before the onset of clinical symptoms in the parodontium. In this regard, the microcirculation system is an extremely sensitive link in which there is a constant change in microhemodynamic parameters. One of the main indicators of the functioning of blood flow is its speed. The assessment of speed characteristics is based on the determination of quantitative parameters of blood flow – volumetric and linear velocities. Flowmetry is an unbiased, non-invasive method for monitoring response to periodontal therapy. Gingival microcirculation exhibits dramatic, dynamic changes in response to the development and progression of periodontitis. According to Kerdvongbundit et al., Inflammation

alters the microcirculatory and micromorphological dynamics of human gums before and after traditional treatment (smoothing of root surfaces), blood flow returned to normal after treatment and remained stable for 3 months after treatment [11]. This contradicts the fact that there are also data from other authors who reported a decrease in blood flow in gingivitis and an increase in the number of superficial vessels [19].

During the study, patients in the comparison group had relatively low values of linear maximal systolic blood flow velocity and volumetric maximal systolic blood flow velocity, which is confirmed by the available literature data on blood flow velocities in small vessels [4].

Biomaterials, which have the properties of the patient's own tissues, reduce the risk of immune rejection and have great potential for tissue regeneration [10].

Based on the foregoing, the plasmogel preparation can be attributed to biomaterials that do not have risks for use in patients with a pronounced immune response, since there are practically no risks of rejection and allergic reactions [11, 15]. In addition, it is important that the drug is easy to use, the gel has good plastic properties, does not spread and is well retained in the area of tissue defects.

The data obtained by us in the course of the study corresponded to previous studies and reflected a general trend towards a decrease in tissue blood flow as the inflammatory-dystrophic process in the parodontium progressed [2, 6, 7].

In general, ultrasound dopplerographs are important tools in periodontal diagnosis and treatment. They may be particularly useful for the prediction and prevention of periodontal disease, as well as for the treatment of various forms of gingivitis and periodontitis. But dopplerography is recommended to be used in combination for the prediction and prevention of periodontal lesions in order to obtain more detailed and accurate data.

Conclusions

1. According to ultrasonic dopplerography, it was found that in patients with generalized periodontitis of chronic course II-III severity, there is a decrease in the linear indicators of blood flow in the microvessels of the parodontium V_{as} – 0.407±0.020 cm/sec., V_{am} – 0.0146±0.009 cm/sec and after the treatment with plasmagel+HA+i-PRF there was an improvement in blood flow, both after 1 year and after 2 years and it was V_{as} – 1.217±0.035 cm/sec., V_{am} – 0.0398±0.0030.

2. It was established that the microhemodynamic characteristics of volumetric blood flow velocities in patients with generalized periodontitis of II-III degree of severity before treatment were minimal: Q_{as} – 0,0141±0,0005 ml/sec., – 0.0007±0.00001 ml/sec, after the treatment in the control group, the indicator Qas was 0.0006±0.000 ml/sec. after 1 year, after 2 years – 0.0005±0.00001 ml/sec., and in the main group with the use of the plasmagel+HA+i-PRF complex after 1 year was 0.0204±0.0030 ml/sec., after 2 years – 0.0109±0.0006 ml/sec. In the Qam control group after 1 year – 0.0006±0.000 ml/sec., after 2 years – 0.0005±0.00001 ml/sec., in the main group, the indicator after 1 year was 0.0204±0.0030 ml/sec., after 2 years – 0.0109±0.0006 ml/sec.

3. In chronic generalized periodontitis of II-III severity, the following algorithm of conservative regenerative technique is recommended: non-injection injection of plasmogel from platelet autoplasma into the periodontal pocket using a cannula 3 procedures with an interval of every 7 days, one-time instillation of the HA preparation and every 6 months in the form of maintenance therapy i-PRF injection using a G30 mesotherapy needle along the transitional fold in the projection of the apices of the teeth, the dose of the drug is about 0.2 ml for each injection, 5 procedures with an interval of every 7 days.

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USE OF INDICATORS OF DYSLIPIDEMIA IN THE DIAGNOSIS OF MASKED FORMS OF ARTERIAL HYPERTENSION

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Taking into account the prevalence of arterial hypertension, its role in the development of cardiovascular diseases and mortality, increasing the effectiveness of the treatment of this pathology remains a topical issue of modern medicine. The purpose of the study is to determine the relationship between elevated blood cholesterol levels and masked arterial hypertension. The study involved 827 people aged 19 to 71, these patients without a history of arterial hypertension were divided into 2 groups: 1) with elevated blood cholesterol levels (n=375); 2) with a normal level of cholesterol in the blood (n=186) – the control group. There were no symptoms of arterial hypertension and the main risk factors (smoking, alcohol, obesity, low physical activity). The average blood cholesterol level was 6.16±0.22 mmol/l in the first group and 4.69±0.18 mmol/l in the control group. In the first group, arterial hypertension was detected in 19 people out of 138 (mean systolic pressure 152.6±4.3 mm Hg, diastolic 97.6±3.7 mm Hg), in 14 of them the cholesterol level exceeded 7.5 mmol/l, in the control group the result was negative. Thus, the use of modern devices makes it possible to detect masked arterial hypertension and carry out appropriate preventive measures.

Key words: cholesterol, metabolic disorders, masked arterial hypertension, risk factors

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ВИКОРИСТАННЯ ПОКАЗНИКІВ ДИСЛІПІДЕМІЇ ПРИ ДІАГНОСТИЦІ МАСКОВАНИХ ФОРМ АРТЕРІАЛЬНОЇ ГІПЕРТЕНЗІЇ

Враховуючи поширеність артеріальної гіпертензії, її роль у розвитку серцево-судинних захворювань та смертності, підвищення ефективності лікування даної патології залишається актуальним питанням сучасної медицини. Мета дослідження – визначити взаємозв'язок між підвищеним рівнем холестерину в крові та маскованою артеріальною гіпертензією. Обстежено 827 осіб віком від 19 до 71 року, з яких виділено 2 групи: 1) основна – із підвищеним рівнем холестерину в крові (n=375); 2) контрольна – з нормальним рівнем холестерину в крові (n=186) – були відсутні симптоми артеріальної гіпертензії та основні фактори ризику (куріння, алкоголь, ожиріння, гіподинамія). Середній рівень холестерину в крові становив 6.16±0.22 ммоль/л в основній групі та 4.69±0.18 ммоль/л у контрольній групі. У першій групі виявлена артеріальна гіпертензія у 19 осіб з 138 (середній систолічний тиск 152.6±4.3 мм рт.ст., діастолічний 97.6 3.7 мм рт.ст.), у 14 з них рівень холестерину перевищував 7.5 ммоль/л, у контрольній групі результат був негативним. Таким чином, використання сучасних приладів дозволяє виявляти масковану артеріальну гіпертензію та проводити відповідні профілактичні заходи.

Ключові слова: холестерин, метаболічні порушення, маскована артеріальна гіпертензія, фактори ризику

The study is a fragment of the research project "A modern approach to assessing the medical and social significance of hypercholesterolemia for public health and the socio-hygienic foundations of its prevention at the population"

Taking into account the prevalence of arterial hypertension (AH), its role in the development of cardiovascular disease and mortality, the effectiveness of AH treatment remains a topical issue for medicine. The main risk factors of lethal outcome of cardiovascular diseases are arterial hypertension (13 %), smoking (9 %), low physical activity (6 %), high blood glucose (6 %) and obesity (5 %) [1, 13]. Elevated levels of cholesterol in the blood also significantly increase the risk of developing ischemic heart disease and stroke [1].