

Angina – Ischemic Heart Disease

[Kardiol Pol.](#) 2007 Jan;65(1):13-21; discussion 22-3.

Laser biostimulation in end-stage multivessel coronary artery disease--a preliminary observational study.

[Article in English, Polish]

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BACKGROUND: Low-energy laser radiation through its direct influence on tissue repair processes without heating effect may have vital importance in the therapy of patients with advanced coronary artery disease (CAD). **AIM:** The introductory assessment of the effects of laser biostimulation applied to patients with advanced multivessel CAD. **METHODS:** 39 patients with advanced CAD were assigned (mean age 64.8 \pm 9.6, male gender 64%, CCS class 2.5 \pm 0.5, EF=46 \pm 11%, 69% with a history of acute myocardial infarction), to undergo two sessions of irradiation of low-energy laser light on skin in the chest area from helium-neon B1 lasers. The time of irradiation was 15 minutes while operations were performed 6 days a week for one month. Before including the patients in the experimental group a full clinical evaluation, basic biochemical tests, ECG, 24h Holter recordings, 6-minute walk test, treadmill test using Bruce protocol and full echocardiographic examination were performed. After the first and second period of laser therapy with a one-month break between them analogical parameters with the initial examination were measured. **RESULTS:** No side effects associated with the laser biostimulation or performed clinical tests were noted. Lower CCS class (2.5 \pm 0.5 --> 2.2 \pm 0.4 --> 2.0 \pm 0.4, p<0.001), higher exercise capacity (5.1 \pm 2.2 --> 5.8 \pm 2.2 --> 6.6 \pm 2.5 [METS], p=0.023), longer exercise time (257 \pm 126 --> 286 \pm 127 --> 325 \pm 156 [s], p=0.06), less frequent angina symptoms during the treadmill test (65% --> 44% --> 38%, p=0.02), longer distance of 6-minute walk test (341 \pm 93 --> 405 \pm 113 --> 450 \pm 109 [m], p <0.001), lower systolic blood pressure values (SP 130 \pm 14 --> 125 \pm 12 --> 124 \pm 14 [mmHg], p=0.05) and trend towards less frequent 1 mm ST depression lasting 1 min during Holter recordings were noted. **CONCLUSIONS:** An improvement of functional capacity and less frequent angina symptoms during exercise tests without a significant change in the left ventricular function were observed. Laser biostimulation in short-term observation was a very safe method. These encouraging results should be confirmed in a larger, placebo-controlled study

[Photomed Laser Surg.](#) 2006 Apr;24(2):111-20.

Photoengineering of tissue repair in skeletal and cardiac muscles.

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This review discusses the application of He-Ne laser irradiation to injured muscles at optimal power densities and optimal timing, which was found to significantly enhance (twofold) muscle regeneration in rats and, even more, in the cold-blooded toads. Multiple and frequent (daily) application of the laser in the toad model was found to be less effective than irradiation on alternate days. It was found that in the ischemia/reperfusion type of injury in the skeletal leg muscles (3 h of ischemia), infrared Ga-Al-As laser irradiation reduced muscle degeneration, increased the cytoprotective heat shock proteins (HSP-70i) content, and produced a twofold increase in total antioxidants. In vitro studies on myogenic satellite cells (SC) revealed that phototherapy restored their proliferation. Phototherapy induced mitogen-activated protein kinase/extracellular signal-regulated protein kinase (MAPK/ERK) phosphorylation in these cells, probably by specific receptor phosphorylation. Cell cycle entry and the accumulation of satellite cells around isolated single myofibers cultured in vitro was also stimulated by phototherapy. Phototherapy also had beneficial effects on mouse, rat, dog and pig ischemic heart models. In these models, it was found that phototherapy markedly and significantly reduced (50-70%) the scar tissue formed after induction of myocardial infarction (MI). The phototherapeutic effect was associated with reduction of ventricular dilatation, preservation of mitochondria and elevation of HSP- 70i and ATP in the infarcted zone. It is concluded that phototherapy using the correct parameters and timing has a markedly beneficial effect on repair processes after injury or ischemia in skeletal and heart muscles. This phenomenon may have clinical applications.

Likars'ka sprava. 2001; (5-6): 111-114.

Evaluation of quantum therapy for the treatment of stable angina

[Otsinka efektyvnosti vplyvu kvantovoi terapii na perebig stabil'noi stenokardii].

A total of 68 patients were examined. Of these, 21 had functional class (FC) I stabile angina, 23 presented with FC II angina, 24 had FC III angina. Instituted in the control group patients (n = 30) was standard antianginal therapy (SAT). Laser therapy against the background of SAT employed has been found to improve the functional state of the myocardium, enhance tolerance to physical loads, improve indices for intracardiac hemodynamics. HeNe laser irradiation has an analgezizing effect. Patients with FC I-III

exertional angina can derive benefit from laser therapy due to its cardioprotective effect. Positive hemodynamic shifts were accompanied by improvement in general health of patients manifested by lower frequency of angina attacks and episodes of pain-free ischemia of the myocardium. Laser therapy had an effect on relation between painful and painless ischemia of the myocardium as evidenced by a predominant decrease in pain-free episodes of myocardial ischemia, this being regarded as a prognostically favourable fact.

Klin Med (Mosk). 2003;81(1):24-7.

[Clinico-functional efficacy of medicinal and photon stabilization of cell membrane in patients with angina pectoris]

[Article in Russian]

[Vasil'ev AP](#), [Senatorov IuN](#), [Strel'tsova NN](#), [Gorbunova TIu](#).

Modification of erythrocytic membrane and the trend in clinicofunctional indices were studied in 90 patients with angina of effort (FC I-IV) in the course of treatment with a combination of membranoprotective drugs (group 1), magneto-laser radiation (group 2) and imitation of laser radiation (group 3). In patients of groups 1 and 2 the treatment resulted in stabilization of cell membrane accompanied with a hypotensive effect and increased exercise tolerance due to more effective cardiac performance.

INFLUENCE OF LOW DOSE LASER THERAPY ON ENDOTHELIAL FUNCTION IN PATIENTS WITH CAD

S. Belousov, E. Galperin, E. Smetova

The purpose of this study was the evaluation of arterial relaxation ability in 15 patients with CAD before and after the course of infrared laser therapy. 18 controls (healthy men). With high-resolution ultrasound and impulse wave doppler we measured the increasing of volumic velocity flow (%) of the arteria poplitea at rest and during reactive hyperaemia (with increased flow causing endothelium-dependent dilatation). In controls flow-mediated mean dilatation was normal. Endothelial dysfunction is present in majority of patients with CAD, flow-mediated dilatation was much reduced or absent. Course of infrared laser therapy was benefit to restore endothelial function in patients with CAD.

Vopr Kurortol Fizioter Lech Fiz Kult. 2003 Jul-Aug;(4):10-3.

[Efficacy of laser therapy in patients with ischemic heart disease]

[Article in Russian]

Vasil'ev AP, Strel'tsova NN, Senatorov IuN.

Modification of erythrocytic membrane and the trend in clinicofunctional indices were studied in 93 patients with angina of effort (FC I-IV) in the course of treatment with laser radiation (group 1) and imitation of laser radiation (group 2). In patients of group 1 the treatment resulted in stabilization of cell membrane accompanied with positive cardiodynamic changes.

Klin Med (Mosk). 2002;80(4):31-3.

[Diagnostic implications of changed red cell count in low-intensity laser radiation of blood in elderly patients with coronary heart disease]

[Article in Russian]

Simonenko VB, Siuch NI, Vokuev IA.

Intravenous laser therapy in combination with medication was conducted in 41 elderly patients with coronary heart disease (633 nm, 1 mW, 124 mW/cm²). The study of qualitative and quantitative (osmotic resistance) erythrocyte indices of blood demonstrated the change of erythrocyte number in circulating blood by the third laser procedure. Frequency of these changes correlated with duration of the treatment course. Intravenous laser therapy had a wider spectrum of effects on erythrocyte number than medication. Changes in erythrocyte number in the peripheral blood upon intravenous laser radiation reflects efficiency of treatment of coronary heart disease patients.

[Vopr Kurortol Fizioter Lech Fiz Kult.](#) 2001 Jul-Aug;(4):3-6.

[The efficiency of low-intensity laser radiation in the treatment of arterial hypertension complicated by ischemic heart disease]

[Article in Russian]

[Shuvalova IN](#), [Klimenko IT](#), [Svinina NG](#), [Tsereteli MV](#), [Zankina VG](#), [Miasoed FR](#).

The efficiency of low-intensity laser radiation (LILR) was studied in the treatment of 291 patients with arterial hypertension and ischemic heart disease. Clinical grounds are given for use of LILR red and infrared rays in rehabilitation of hypertensive patients with ischemia. The rehabilitation regimens can be differentiated according to the disease severity, type of hemodynamics, state of cerebral circulation.

[Vopr Kurortol Fizioter Lech Fiz Kult.](#) 2001 Nov-Dec;(6):10-3.

[Laser irradiation in the treatment of ischemic heart disease]

[Article in Russian]

Vasil'ev AP, Strel'tsova NN, Senatorov IuN.

Cardiodynamic changes due to beta-blocker carvedilol and low-intensity infrared laser radiation were compared in 115 patients with ischemic heart disease (IHD). The comparison has shown a similar positive effect on heart contractility and diastolic function. This gave arguments for feasibility of laser beam usage as a neurohormonal modulator in IHD patients to reduce cardiac remodeling and prevent cardiac failure.

Vopr Kurortol Fizioter Lech Fiz Kult. 2003 May-Jun;(3):22-5.

[Antioxidant action and therapeutic efficacy of laser irradiation of blood in patients with ischemic heart disease]

[Article in Russian]

Volotovskaia AV, Ulashchik VS, Filipovich VN.

Laser irradiation in therapeutic doses ($\lambda = 632.8$ nm, 14 mW) has an antioxidant effect in blood irradiation in vitro as shown by activation of superoxide dismutase (SOD) which is a key enzyme of the antioxidant system (AOS) and suppression of lipid peroxidation. Adjuvant supravascular He-Ne laser irradiation of blood in combined therapy of 82 patients with ischemic heart disease (IHD) produces a positive trend in the clinical picture, hemostasis, lipid metabolism, blood SOD activity. Thereby, this method of laser hemotherapy is recommended for use in IHD patients. The dependence of the treatment results on the initial blood AOS necessitates consideration of AOS state in deciding on laser therapy in this group of patients.

Vopr Kurortol Fizioter Lech Fiz Kult. 2002 Jul-Aug;(4):9-11.

[Use of infrared laser therapy in patients with ischemic heart disease associated with diabetes mellitus type 2 in health resort]

[Article in Russian]

Zin'kovskaia TM, Zavrzhnykh LA, Golubev AD.

Infrared laser therapy (300 Hz) combined with balneotherapy and patients' education is more effective than standard sanatorium rehabilitation in patients with ischemic heart disease associated with diabetes mellitus type 2. 81.8% patients showed good response manifesting in less frequent anginal attacks, episodes of pain and painless ischemia and lower doses of antianginal drugs. Systolic and diastolic arterial pressure lowered by 18 and 10 mm Hg on the average, respectively. Multimodality rehabilitation of IHD patients

with type 2 diabetes mellitus improves hemostasis, carbohydrate and lipid metabolism. Coronary circulation response lasted for 24 weeks.

EFFECTS OF LASER THERAPY ON VENTRICULAR AND SUPRAVENTRICULAR EXTRASYSTOLES IN PATIENTS WITH ANGINA PECTORIS OF 1-3 FUNCTIONAL CLASSES

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The aim of the present investigation is to study the effect of low level laser on extrasystoles. The amount of extrasystoles is registered before treatment and on the 10th day after the therapy. 64 patients with angina pectoris underwent laser therapy. We registered patients with more than 200 supraventricular extrasystoles and with more than 100 ventricular extrasystoles before our therapy. The treatment was carried out the keep of GaAs laser - "Elat" (890 nm) with pulse regime. The region of projection of carotide sinuses and heart were irradiated with pulse repetition rate 150 - 300 Hz with expositions 20 min. The amount of extrasystoles was counted by Holter monitor device. Laser therapy lessened supraventricular extrasystoles from $308,4 \pm 29,6$ to $134,6 \pm 21,8$ ($p < 0,001$) and ventricular extrasystoles - from $182,1 \pm 31,3$ to $41,5 \pm 16,3$ ($p < 0,05$) in patients with 1-3 functional class. We observed a decreased number of extrasystoles in 2 FC by 39,9 percent and by 13,7 percent, respectively. On patients with 3 FC - by 38,7 percent ($p < 0,001$) and by 13,3 percent ($p < 0,05$), respectively. This effect could still be observed after two months after the treatment. The results showed, that laser therapy lessened extrasystoles and that it can be applied as an effective means when treating ventricular and supraventricular extrasystoles in patients with angina pectoris 1-3 FC.

THE EFFECTIVENESS AND INFLUENCE ON RHEOLOGICAL BLOOD FEATURES AND ENDOTHELIAL VESSELS FUNCTION OF INFRARED LASER THERAPY IN PATIENTS WITH ANGINA PECTORIS

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One can observe the impairment of endothelial vessels function (EVF) and rheological blood features (RhBF) in patients with various forms of ischemic heart disease. The task of this investigation is the study of infrared laser therapy (IRLT) influence to RhBF, EVF; the dependence of treatment effectiveness from above stated functions. 58 patients with stable angina pectoris III and IV functional class where under supervision. IRLT was performed by means of USOR and ASOR-2K apparatus with rate 300 Hz, the procedure lasted 10 minutes and it was given 10 times. To evaluate treatment

effectiveness and its dependence on RhBF we have studied erythrocyte aggregation (EA), we have counted erythrocyte aggregation coefficient (EAC), the erythrocyte flowing (HF), it was marked by the index of flowing (IHF), spontaneous thrombocytcs aggregation (SThA) before and after IRLT and capillary fragility test (CFT). Before IRLT EAC was 0.78 ± 0.04 , after it was 0.89 ± 0.06 ($p < 0.05$), standard - 1.0. Before IRLT IEF was $80,44 \pm 0.96\%$, after it was $90.47 \pm 0.91\%$ ($p < 0.05$). SThA was higher standard in the majority of patients before therapy. It decreased after the therapy. After CFT SThA reduced in patients given IRLT ($25.81 \pm 1.50\%$, $20.39 \pm 0.91\%$ and $17.51 \pm 0.11\%$). The lowering of SThA did not occur in patients treated only with medical preparations. The IRLT was effective in 91.7%. The effect of therapy was higher in patients with reliable lowering of EA, SThA, increased IEF. Therefore the IRLT is highly effective method of angina pectoris treatment and improves rheological properties of blood and endothelium vessels function.

RESULTS OF 10-YEAR USE OF LOW INTENSITY LASER THERAPY AND CONVENTIONAL TREATMENT OF PATIENTS WITH STENOCARDIA

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The improvement of treatment and rehabilitation of patients with CHD remains to be a vital problem in cardiology, as morbidity, disability and mortality rates keep steadily growing. However, insufficient efficacy of therapeutic methods, the development of retraction to antianginal drugs, their intolerance make medical men search for the new methods of CHD treatment, nonmedicamental ones inclusive. This paper presents the results of 10-year observation over two groups of patients with CHD (the main and control). 280 patients, who underwent a course of laser therapy (LT), have been included in the main group (A), the control (B) 155 patients have been treated conventionally. Prospective observation demonstrated new cases of acute myocardial infarction (AMI), mortality from CHD as well. There were 26 cases of AMI (II, 9 cases per 1000 population a year) in the main group, 27 AMI cases (27.4 per 1000 people a year) in the control over the observation period. The analysis of the acute attack and AMI development incidence in II - IV functional class (FC) stenocardia patients for 5 years before and after LT annual course demonstrated that the patients who underwent the repeated antirelapsing course of low intensity LT during remission showed reliable advantage ($p < 0,01$ to $p < 0,05$) of the method used as well as its prophylactic effect to prevent CHD progressing which was confirmed by biochemical blood analysis (lipid metabolism and rheologic properties). During the observation period there were 54 deaths: 8,9% in the main and 18,7% in the control group. CHD was the main cause of death in both groups which made 84% and 89.6% respectively of all death causes. Mortality rate was 17,4 and 32,6 respectively per 1000 population a year ($p < 0,01$). On the whole, prospective analysis of the obtained data showed that LT course is directly dependent on its type and frequency of repeated courses and enables to prolong therapeutic remission of CHD by 2,5 times on the average. Thus, low intensity LT is a

method of choice for patients suffering from different forms of angina pectoris and is carried out either in combination with conventional drug therapy or alone.

Vopr Kurortol Fizioter Lech Fiz Kult. 1997 Sep-Oct;(5):9-11.

[The dynamics of the clinico-functional indices in patients with ischemic heart disease under the influence of repeated courses of laser therapy]

[Article in Russian]

[Vasil'ev AP](#), [Strel'tsova NN](#).

Repeated courses of laser therapy given to patients with ischemic heart disease, angina of effort class I-IV for 2 years brought about stabilization of coronary insufficiency and improvement of clinical and functional conditions. Microcirculatory picture of the bulbar conjunctiva, coronary reserve improved. The treatment had also a hypotensive effect.

[Vopr Kurortol Fizioter Lech Fiz Kult](#). 1996 Mar-Apr;(2):5-8.

The effect of exposure to magnetics and lasers on the clinical status and the electrophysiological indices of the heart in patients with cardiac arrhythmias

[Article in Russian]

[Budnar' LN](#), [Antiuf'ev VF](#), [Oranskii IE](#), [Bekhter TV](#).

Magnetolaser radiation has a considerable influence on electrophysiological condition of the sinus node and sinoatrial zone. There are cases when patients with sick sinus syndrome get rid of arrhythmia. The treatment is safe and promising for further studies.

INTRAVENOUS A LASER IRRADIATION OF BLOOD IN COMPLEX REHABILITATION OF THE PATIENTS WITH ISCHEMIC HEART DISEASE IN THE SENIOR AGE GROUPS

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The problem of rehabilitation of the ischemic heart disease (IHD) patients remains essential. Use of physical methods of treatment of the given category of the patients in connection with numerous lacks in drug treatment (collateral action, decrease of tolerance with long treatment, sometimes their inaccessibility for continuous treatment) gets the increasing distribution. 32 IHD patients are surveyed, from them 6 IHD patients had a combination with arterial hypertension. Average age explore patients - 66 ± 4 years. On a background of a dietary nutrition and basic treatment with nitrates have carried out an irradiation of blood by the helium-neon laser through light-guide in cubital vein with

capacity 1,5 mW, exposition - 30 minutes once per day within ten days. As a result of complex treatment there has come an improvement of a common condition of the patients was noted, normalization of rheological parameters of blood. Thus, intravenous laser blood irradiation can be used for the treatment of patients with IHD in stage of the ambulatory rehabilitation, including the patients of the senior age groups.

THE APPLICATION OF LOW-INTENSITY LASER RADIATION FOR THE TREATMENT OF INFARCTIONAL PATIENTS WITH EARLY ANGINA PECTORIS REFRACTING TO THE DRUG THERAPY

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The results of treatment by low-intensity laser radiation of blood are given with taking into account of individual sensitivity in process of laser therapy. 600 patients with myocardial infarction and early angina pectoris (500 patients simultaneously with drug therapy were given laser therapy, 100 patients were given only drug therapy) were examined. The selecting of dose of laser radiation was based on refraction index of blood plasma in the field of laser radiation *in vitro*. Before the starting of laser therapy, in the middle of the course and at the end of it the state of health was estimated according to the theory of stress by Selie. In the group of patients, receiving laser therapy, the pronounced positive clinical effect has been registered. According to our data this effect reflects the changing of blood coagulation.

EFFICIENCY OF INTRAVASCULAR BLOOD IRRADIATION WITH HE-NE LASER IN PATIENTS WITH STABLE EFFORT ANGINA PECTORIS DEPENDING ON FUNCTIONAL CLASS

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The aim of this study was the comparison of antianginal effect of intravascular He-Ne laser irradiation of blood (ILIB) in patients with different functional classes of angina pectoris. The tolerance to exercise was studied in 44 men with stable angina, functional classes I-II have been registered in 20 patients, functional classes III-IV - in 24 patients. Four veloergometer tests both before and after the course of invasive treatment were performed for every patient under circumstances of total abolition drugs. All 44 patients were randomized by the blind method into ILIB and placebo groups. Nine men with the slight angina pectoris and 15 patients with the painful angina pectoris were subjected to 6 ILIB seances, the total course dose was $21,6 \pm 0,8$ J. We used the He-Ne laser radiation (wavelength 632,8 nm) from the three-wave laser therapy device "Adept", the light power in the end of intravenous light-guide was from I to 2 mW. Other 11 patients with angina functional classes I-II and 9 patients with angina pectoris functional classes III-IV received the placebo course of six invasive procedures. The effect of ILIB was calculated as a difference of increases in the mean-sample maximum workload between the laser therapy group and the placebo group. In patients with severe angina ILIB increased the exercise power reached on veloergometer on the average by $7,3 \pm 3,2$ W ($t = 5,26$; $p = 0$).

In contrast, in patients with the high tolerance to exercise ILIB did not significantly affect this parameter. We obtained the great difference in effects of ILIB in patients with the serious angina pectoris and the mild stenocardia ($t = 2,41$, $p = 0,03$). Thus, efficacy of the invasive blood irradiation with He-Ne laser in patients with stable effort angina pectoris depended on the initial tolerance to exercise.

INFLUENCE OF INTRAVENOUS BLOOD IRRADIATION WITH HE-NE LASER ON THE ANTIANGINAL EFFECT OF NITROGLYCERIN IN PATIENTS WITH STABLE EFFORT ANGINA PECTORIS

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We reported about the significant antianginal effect of intravenous He-Ne laser irradiation of blood (ILIB) in patients with serious stable effort angina functional classes 3-4. The goal of this work was to investigate an action of ILIB on an increase of the tolerance to exercise after the sublingual taking nitroglycerin in dose 0.5 mg in patients with stenocardia. We observed 27 men with stable effort angina functional classes II-IV. All patients were subjected two conjugate loading tests on veloergometer with nitroglycerin both before and after of the seven-day treatment. The antianginal effect of nitroglycerin was calculated as the magnitude of the increase maximum workload after taking nitroglycerin in comparison with the initial level of the maximum exercise power. Patients were divided randomly into main and control groups (17 and 10 men accordingly). Patients from the master group were subjected to six seances of ILIB. Power at the light-guide end was 1-2 mW, the accumulated dose was 21.6 ± 0.8 J. The control group received the course of 6 invasive 45-minute placebo procedures that outwardly were like seances of ILIB. Both the intravascular laser treatment and its imitation were performed with three-wave laser therapy device "Adept". In all patients invasive procedures were combined with antianginal medication treatment that was abolished 1 -2 days before loading tests. Although after the treatment the increase of antianginal effect of nitroglycerin was not statistically significant in both groups, nevertheless after ILIB the rise of nitroglycerin's effect was more by 63 per cent as compared with placebo ($p > 0.9$). Thus, ILIB not only increases tolerance to exercise in patients with severe stable effort angina, but also it is not decreases the antianginal effect of nitroglycerin.

Vopr Kurortol Fizioter Lech Fiz Kult. 2002 Jul-Aug;(4):9-11.

[Use of infrared laser therapy in patients with ischemic heart disease associated with diabetes mellitus type 2 in health resort]

[Article in Russian]

Zin'kovskaia TM, Zavrazhnykh LA, Golubev AD.

Infrared laser therapy (300 Hz) combined with balneotherapy and patients' education is more effective than standard sanatorium rehabilitation in patients with ischemic heart disease associated with diabetes mellitus type 2. 81.8% patients showed good response manifesting in less frequent anginal attacks, episodes of pain and painless ischemia and lower doses of antianginal drugs. Systolic and diastolic arterial pressure lowered by 18 and 10 mm Hg on the average, respectively. Multimodality rehabilitation of IHD patients with type 2 diabetes mellitus improves hemostasis, carbohydrate and lipid metabolism. Coronary circulation response lasted for 24 weeks.

Sov Med. 1990;(3):12-5.

[Helium-neon laser therapy in the combined treatment of unstable stenocardia]

[Article in Russian]

Korochkin IM, Kapustina GM, Babenko EV, Zhuravleva NIu.

He-Ne laser therapy included in complex of therapeutic methods for patients with unstable angina pectoris is a highly effective treatment modality; it helps essentially reduce the risk of acute myocardial infarction in these patients. Clinical efficacy of laser therapy is confirmed by its favorable action on hemostasis plasma factors, consisting in reduction of fibrinogen level, normalization of antithrombin-III (AT-III), decrease of the level of soluble fibrin monomer complexes, this indicating a lowering of the blood coagulation potential. Absence of significant changes in plasminogen level may be an indicator of the nonenzymic route of fibrinogen system activation. Sessions of intravenous laser therapy should be administered 2-3 times a week to unstable angina pectoris patients with low AT-III levels, whereas for patients with initially high or normal AT-III levels combined laser therapy is advisable (4-5 daily invasive procedures and 6-8 skin surface ones on the Zakharyin-Head's zones). Measurements of endogenous anticoagulants is an effective means for monitoring laser therapy in this patient population.

Vestn Khir Im I I Grek. 2000;159(2):60-4.

[The effect of different methods of photohemotherapy on the rheological properties of the blood in patients with ischemic heart disease]

[Article in Russian]

Gavrisheva IA, Dutkevich IG, Pleshakov VT, Kolesnik VS.

The authors made an analysis of results of examination of 41 patients with ischemic heart

disease treated by the standard medicamentous therapy and when using different methods of photohemotherapy against its background. It was established that medicamentous therapy during 2 weeks failed to result in a substantial improvement of rheological properties of blood, while its combination with photohemotherapy could give a considerable positive effect coinciding with clinical improvement of the patient's state. Shorter terms are required to correct hemorheological indices when autotransfusions of photomodified blood are used.

Vopr Kurortol Fizioter Lech Fiz Kult. 1995 Jan-Feb;(1):5-7.

[The effect of different types of laser therapy on the reactivity of the peripheral blood neutrophils in patients with ischemic heart disease]

[Article in Russian]

[Siuch NI](#), [Illarionov VE](#).

The responses to laser therapy (intravenous, continuous skin exposure without a magnet, magnetic laser therapy) of 83 patients with coronary heart disease aged 50-80 demonstrated the advantages of noninvasive laser irradiation of blood. Myeloperoxidase activity may serve a criterion for estimating the number of irradiation procedures needed.

Kardiologiya. 1993;33(2):22-3.

[Changes in central hemodynamics and microcirculation during laser therapy in patients with coronary insufficiency]

[Article in Russian]

[Gel'fgat EB](#), [Samedov RI](#), [Kurbanova ZN](#), [Gadzhiev GG](#).

The study was undertaken to examine 45 patients with Stages IIB-III heart failure (HF) by the classification developed by V. Kh. Vasilenko and N. D. Strazhesko. Thirty patients had laser therapy in addition to the routine treatment, 15 patients served as a control group. The combined drug treatment along with laser therapy in patients substantially improved peripheral circulatory parameters than in the controls. There was a positive dynamics of central hemodynamic parameters as shown by lower left ventricular volumes and higher myocardial contractile and pump functions. Improvement of microcirculatory and central hemodynamic parameters in patients treated with laser occurred in earlier periods of hospital stay than in the controls.

Vopr Kurortol Fizioter Lech Fiz Kult. 1996 Mar-Apr;(2):3-5.

[The laser therapy of patients with hypertension in combination with coronary insufficiency]

[Article in Russian]

[Kniazeva TA](#), [Badtieva VA](#), [Zubkova SM](#).

Hypertensive patients with coronary insufficiency have received infrared ($\lambda = 0.85$ microns) laser radiation to the skin. The treatment is shown to have antianginal, antihypertensive effects, to improve cardiac performance, myocardial contractility, to increase myocardial, coronary and aerobic reserves. This clinicofunctional efficacy is accompanied by positive shifts in lipid metabolism, lipid peroxidation activity, antioxidant defense, hemocoagulation and microcirculation.