

Laser therapy in cardiovascular diseases



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ABSTRACT

Cardiovascular disease is the number one cause of death worldwide. It is broadly defined to include anything which adversely affects the heart or blood vessels. One-third of Americans have one or more forms of it. By one estimate, average human life expectancy would increase by seven years if it were eliminated.

The mainstream medical model seeks mostly to “manage” cardiovascular disease with pharmaceuticals or to surgically bypass or reopen blocked vessels via angioplasty. These methods have proven highly useful and saved countless lives. Yet drug therapy may be costly and ongoing, and it carries the risk of side effects while often doing little or nothing to improve underlying health concerns. Similarly, angioplasty or surgery are invasive methods which entail risk.

Laser therapy^[1] regenerates tissue, stimulates biological function, reduces inflammation and alleviates pain. Its efficacy and safety have been increasingly well documented in cardiovascular disease of many kinds. In this article we will explore the effects of laser therapy in angina, atherosclerosis, coronary artery disease, hypertension, hyperlipidemia, myocardial infarction, stroke and other conditions. The clinical application of various methods of laser therapy, including laserpuncture and transcutaneous, supravascular and intravenous irradiation of blood will be discussed. Implementing laser therapy in the treatment of cardiovascular disease offers the possibility of increasing the health and wellbeing of patients while reducing the costs and enhancing safety of medical care.

Keyword list: cardiovascular, low level laser, laser therapy, heart disease, hypertension, atherosclerosis.

1. THE NATURE, SCALE AND COSTS OF CARDIOVASCULAR DISEASE

Cardiovascular disease is the leading cause of death worldwide. Broadly defined to include anything adversely affecting the heart or blood vessels, the term embraces a vast range of conditions, including angina/coronary artery disease, atherosclerosis, hypertension, myocardial infarction, rhythm disturbance, stroke and more.

In the U.S. in 2004, cardiovascular disease claimed 869,724 lives, 36 % of total mortality. In 2005 more than eighty-one million Americans were believed to have one or more forms of it.[1] According to one estimate,

our average life expectancy would increase by seven years if cardiovascular disease were eliminated.[2] The numbers of people affected and the costs for their care are staggering.

Atherosclerosis, the build-up of plaque within arteries, is the common root of nearly all cardiovascular disease. As the lumen of a coronary or cerebral artery decreases, flow diminishes, eventually resulting in an insufficiency of blood to the heart or brain. Also, the plaques themselves may rupture and combine with platelets to form a thrombus, completely obstructing blood flow. When the blood supply is completely interrupted to the heart the resulting injury is a myocardial infarction. Similarly, stroke is the consequence when this same process occurs within the brain. There were 8,100,000 myocardial infarctions, 9,100,000 cases of angina and 5,800,000 strokes in 2005.[3] More than 450,000 Americans died from coronary artery disease in 2004, making it the leading, single cause of death.[4] The total cost of cardiovascular disease, including stroke, in the United States in 2008 has been estimated at \$448.5 billion dollars.[5]

If cost-effective strategies to reverse or prevent the process of atherosclerosis were available, perhaps many of these heart attacks, strokes and deaths could be avoided and many billions of dollars put to better use. Considering the monetary burden of current treatment methods, implementing such approaches, might significantly help to restore America's financial health as well.

2. STANDARD U.S. MEDICAL PRACTICE IN CARDIOVASCULAR DISEASE

As of the time of this writing, standard medical practice in cardiovascular disease in the U.S. has focused almost entirely on three methods.

2.1 Heart surgery

Modern cardiac surgery began in 1953 when the defect in a patient's ventricular wall was sutured shut while her blood was being circulated and oxygenated artificially.[6] By 1967 methods to bypass blocked coronary arteries with vein grafts had been developed. Surgery to route additional blood flow to the heart muscle rapidly became the most popular kind of cardiac procedure.[7]

Cardiac surgery includes the complicated repair of congenital anomalies, valve restoration or replacement and a variety of other procedures. Yet more than two out of three cardiac surgeries are performed to direct blood flow via vein or other grafts to bypass coronary arteries obstructed by atherosclerosis. Cardiac surgery is complex, expensive and entails risk, and some have suggested performing such procedures to address coronary artery disease is extravagant and overkill. In 2005 469,000 of the total 699,000 cardiac procedures performed in the United States were coronary artery bypass graft operations.[8]

2.3 Coronary angioplasty

Coronary angioplasty was developed as a less invasive means to reopen blocked coronary arteries, avoiding surgery. In 1977 a balloon tipped catheter was used successfully to perform the first coronary angioplasty on an awake human. By 2005 1,265,000 percutaneous coronary interventions were being performed annually in the United States.[9] The development of stenting has also been considered a major advance. Even more than heart surgery, coronary angioplasty, with or without stenting, is focused almost completely on the consequences of atherosclerosis in tiny but vital coronary arteries.

2.3 Pharmaceutical drugs

Pharmaceutical drugs have been applied in cardiovascular disease since the discovery of digitalis. They have proven useful in controlling most of the signs and symptoms of cardiovascular disease. Since World War II the numbers and variety of drugs and classes of agents available has grown by leaps and bounds to include nitrates, diuretics, alpha and beta blockers, calcium channel blockers, angiotensin converting enzyme inhibitors, anticoagulants and statins. The latter group in particular has been advocated recently as a means to prevent, slow or possibly even reverse atherosclerosis. Yet while the pharmaceutical industry has consistently shown the highest earnings of all American business, drug prices have risen far more rapidly than inflation or wages, leaving many struggling or unable to pay for what may be or is often perceived as a medical necessity. Are safe, cost-effective alternatives available?

3. LASER THERAPY

Laser therapy[2] is the most common term used to describe treatment with low intensity laser light. Generally, it is given at modest levels below the onset of thermal damage and at non-ionizing wavelengths in the red to near infrared portion of the spectrum. Laser therapy has been given high marks by scientists and physicians across a broad range of medical conditions over more than 40 years of clinical and research use. Cardiovascular disease is one of many areas in which laser therapy has been shown to excel.

3.1 A brief history of laser therapy

Laser therapy's biological effects were first described by Hungarian scientist Endre Mester in 1966-1967. By 1971 laser therapy had exploded across eastern Europe throughout the countries of the former Soviet Union where it is well accepted and widely applied as standard practice across many medical disciplines today. There have been numerous innovations. The most important of these perhaps is intravenous laser blood irradiation. This technique was originally developed to treat acute myocardial infarction in 1981 but was rapidly recognized to have great therapeutic potential to address a broad range of medical conditions.

3.2 Methods of laser therapy.

Laser therapy is being applied in many ways, including contact treatment, scanning without contact, via endoscopy, by specialized applicators directly into organs and other targets, by intravenous, extracorporeal, supravascular and transcutaneous irradiation of blood and through laserpuncture. Positive outcomes have been documented with all of these approaches.

It is worth mentioning that since laser therapy has been studied in research and applied clinically for more than forty years, many techniques and treatment protocols are already well established. Laser therapy has been reported to work astonishingly well in a great many conditions, employing many different techniques, powers, wavelengths, dosages and intensities.

Two popular methods of administering laser therapy found helpful in addressing cardiovascular disease according to the scientific literature are intravenous blood irradiation and transcutaneous laser irradiation over the heart and blood vessels. It is relatively simple to administer laser blood irradiation directly into a vein via fiberoptics which conduct laser light. Helium-Neon lasers emitting 1-3 milliwatts have been popular Russian devices for laser blood irradiation. Treatments generally last 20 to 60 minutes, and a course of therapy may be 3-10 sessions.[10]

3.3 Biological effects and mechanisms of laser therapy

Four well accepted biological effects of laser therapy are:

- Biostimulation / tissue regeneration
- Reduction of inflammation
- Analgesia
- Antimicrobial.[11]

One fundamental way in which laser therapy energizes living systems is through photon absorption by mitochondria to activate the respiratory chain and increase synthesis of ATP. By increasing energy available in this readily accessible form, laser light is able to profoundly stimulate the biological function of cells, tissue, and system and has even been reported to increase overall health and vitality. Laser therapy accelerates and may initiate tissue regeneration, promoting the activities and numbers of formative cells. It has been documented to stimulate the healing of tissue of many kinds, bone, blood, cartilage, nerve and muscle and even to improve its quality.

When given intravenously to irradiate the blood, the effects of low intensity laser light have been described primarily as systemic rather than local and even said to increase the efficiency of the entire organism, enhancing activity of the vascular, immune and other systems, increasing oxygenation of tissue and blood, stimulating red blood cell formation, reducing blood viscosity and enhancing the deformability of red blood cell membranes to improve the rheological characteristics of the blood and increase microcirculation, promoting the activities of macrophages, and nonspecific mechanisms of anti-infectious immunity, increasing IgA, IgM and IgG in the blood and intensifying bactericidal activity of serum. Levon Gasparayan notes that intravenous laser blood irradiation improves the general condition of patients, writing that it “..is used for its biostimulative, analgetic, antiallergic, immunocorrective, antitoxic, vasodilative, antiarrhythmic, antibacterial, antihypoxic, spasmolytic, anti-inflammatory and some other properties.”[12]

3.4 Safety of laser therapy

Laser therapy has proven to be extremely safe. In the more than 40 years since this method was discovered, an adverse reaction has never been reported in the over 4,000 published studies and articles.

4. CASE STUDIES

4.1 Case study – irregular cardiac rhythm

“Renee” was a 57 year old female whose chief complaint was frequent palpitations x 2 years as well chest tightness and moderate pain at times. She had been diagnosed with mitral valve prolapse with regurgitation 7 years earlier and was also experiencing knee pain, low energy, stress, digestive disturbance and insomnia. She received 13 regular visits for laser therapy and acupuncture in her first treatment series along with 10 consecutive daily bioelectromagnetic therapy sessions at the outset.

“My heart is steady,” she said after 12th visit, noting that she had experienced only very occasional, brief palpitations in the last four weeks. She reported virtually no palpitations for 1 month following the 13th and last visit in the series and noted, “Stress is much lower when you’re heart is behaving.” At 3 months she reported mild palpitations which resolved following two additional treatments.

4.2 Case study – essential thrombocytosis

“Kris” was a 44 year old female with essential thrombocytosis whose platelet counts were in excess of 900,000. Her chief complaints were tenderness over the left lower ribs and costochondral area, dull, right hip and left lower back pain and frequent heart palpitations. Her spleen was mildly enlarged on CAT scan. She came seeking an alternative to hydroxyurea which had been recommended by her hematologist.

All symptoms disappeared or improved with laser treatment. (By the 10th visit her platelet count had dropped to 733,000, the lowest in a year and a half.) She then stopped coming.

After a month without treatment, palpitations, sore hip and tenderness over the spleen returned, though less intensely. She received 5 additional treatments.. All signs and symptoms were alleviated and, at the time of this writing, it has been 5 months since her last visit.

4.3 Case study – hypertension

“Robert” was a 71-year-old diabetic with a long history of hypertension and heart disease. One day, he stopped taking all nine of his medications (three of which were for blood pressure) and showed up at our office, diaphoretic and pale. His blood pressure measured 220/125, and it was suggested that he take his drugs. He adamantly refused. He was treated three times, approximately five days apart, with supravascular laser therapy and acupuncture, and also was given herbs.

Robert’s Blood Pressure Measurements

Visit	BP Pre-Treatment	BP Post-Treatment
1 st visit	220/125	195/115
2 nd visit	190/110	160/98
3 rd visit	160/92	148/88

Note that pre-treatment blood pressure readings moved downward progressively, not just readings taken after treatment. [13][3]

5. WHAT RESEARCHERS REPORT IN THEIR OWN WORDS ABOUT

LASER THERAPY’S EFFECTS IN CARDIOVASCULAR DISEASE

5.1 Laser therapy in myocardial infarction and coronary artery disease

“Progression of coronary atherosclerosis often causes complications resulting in myocardial infarction, early disability and death of patients with coronary heart disease. Low efficacy of medicines against coronary atherosclerosis progression after myocardial infarction gave rise to investigations of nonpharmacological methods, laser radiation, in particular. Our study shows a noticeable positive effect of low-intensity laser radiation on blood lipid spectrum and hemostasis. This makes laser therapy promising in combined rehabilitation of postmyocardial infarction patients.”[14]

“The LELI caused a 1.8-fold significant increase in the rate of proliferation in endothelial cells in culture over nonirradiated cells. It is concluded that LELI can promote the proliferation of endothelial cells in culture, which may partially explain the augmentation of angiogenesis in the CAM model and in the infarcted heart.

These results may have clinical significance by offering therapeutic options to ameliorate angiogenesis in ischemic conditions.”[15]

“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.”[16]

“The aim of this work was to investigate the myocardial protection against ischemia/reperfusion using low level laser irradiation (LLLI). It has been shown that pulse pressure was higher in the period of post-ischemic reperfusion as compared with the control group. It provided a better restoration of myocardial contractility as well as increasing of coronary flow in the reperfusion period. The amount of ventricular rhythm disorder episodes decreased.”[17]

“LLLI of the infarcted area in the myocardium of experimentally induced MI rats, at the correct energy, duration and timing, markedly reduces the loss of myocardial tissue. This phenomenon may have an important beneficial effect on patients after acute MI or ischemic heart disease.”[18]

“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.”[19]

“Influence of laser therapy on vascular endothelium function in patients with stable angina pectoris, detected by the method of laser Doppler fluorimetry, was studied. 77 patients with stable angina pectoris were divided into 2 groups. In control group only medicamentous therapy was used, in main group a course of intravenous blood laser irradiation was carried out additionally. The increase of initially decreased mean index of microcirculation and index of microcirculation after acetylcholine iontophoresis was noticed. Tendency to increase of endothelial oscillations and capillary blood flow under influence of intravenous blood laser irradiation was noticed too. Laser therapy can be considered an effective method of increase of endothelial functional activity in patients with stable angina pectoris.”[20]

“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.”[21]

“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.”[22]

“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.”[23]

“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.”[24]

“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.” [25]

“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.”[26]

“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.”[27]

“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.”[28]

“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.”[29]

5.2 Laser therapy in atherosclerosis

“The authors describe comparative results of treatment of 60 elderly and senile patients with obliterating atherosclerosis of the lower extremity vessels. In 50 patients treatment with traditional medicines was combined with intravascular laser irradiation of blood, 10 patients were treated with traditional medicines only. The data obtained by questionnaires concerning the patients’ state, expert judgment of doctors in charge

of the profile department, indices of instrumental examinations of regional hemodynamics (rheovasography of the lower extremity vessels), data of laboratory investigations of morphofunctional state of erythrocytes and hemorheology showed that laser irradiation of blood gave better results of treatment. Its therapeutic effect persisted during 3 months in most patients.”[30]

“The control group consisted of 12 healthy subjects, the comparative group included 15 patients who received standard therapy of vascular diseases but without physiotherapy. The study group consisted of 44 patients whose treatment was supplemented with laser irradiation. Angiography, ultrasonic dopplerography, laser flowmetry, oxygenometry were applied for control of treatment efficacy. Regional ischemia was evaluated with detection of pO₂ of foot. LT increased oxygenation of foot soft tissues in patients with low primary pO₂ and decreased in ones with higher. As a result the number of patients with low pO₂ ($0 < pO_2 < 20$) decreased from 13.7 to 4.5%, with middle pO₂ ($20 < pO_2 < 40$) increased from 27.3 to 50.0%, with high pO₂ ($pO_2 = 40$) decreased from 59.0 to 45.5%. Redistribution in favor of $20 < pO_2 < 40$ is regarded as normalizing effect of LT. It is concluded that LT increases oxygenation of foot soft tissues in patients with low primary pO₂ and decreased in ones with higher.”[31]

“It is shown that laser therapy used in a multiple-modality treatment of patients with obliterating atherosclerosis of vessels of the interior limbs presenting with stage I-III ischemia permits achieving a substantial clinical effect manifested subjectively by fewer complaints or disappearance thereof in a proportion of patients, which fact is corroborated by objective findings such as increase in peripheral, volumetric blood flow and lower degree, in some patients, of ischemia of the extremities, improvement in processes of microcirculation and hemocoagulation. The use of laser radiation and pneumocompression combined in treatment of patients with chronic arterial insufficiency of the lower extremities of atherosclerotic genesis has been shown to have a more marked and appreciable effect. The studies made broaden our possibilities of conservative non-medicamentous treatment of obliterating atherosclerosis of vessels of the lower extremities.”[32]

“The efficiency of supravascular laser exposure in multiple-modality treatment of patients with atherosclerosis obliterans with distal vascular lesions is demonstrated and the method of noninvasive laser exposure of the lower limbs is validated. Difficulties in the treatment of this category of patients prompted supplementing traditional therapy by supravascular laser exposure in 32 patients.”[33]

“The authors analyze the results of clinical application of intravenous He-Ne laser irradiation of the blood in patients with obliterating diseases of the limb vessels. Starting from 1984, this method was employed in the treatment of 133 patients, of these 102 ones with atherosclerosis obliterans of the lower limb vessels, 17 with endarteritis obliterans, and 14 with Raynaud’s syndrome. Intravenous laser therapy proved to be the most effective in atherosclerotic involvement of the vessels, when positive result was achieved in 77.5 percent of patients. The length of remission was up to 6 months.”[34]

5.3 Laser therapy hypertension

“Liquidators of Tchernobyl accident with discirculatory post-irradiation encephalopathy were treated with infra-red laser irradiation together with a half doze of pharmacological agents usually used. Infra-red laser irradiation has been shown to result in a significant reduce in the arterial pressure level, so it can be effective in correcting the disturbances in haemodynamics.”[35]

“In a placebo-controlled trial of males with stage I essential hypertension, laser therapy as a monotherapy significantly lowered systolic, diastolic and mean arterial pressure along with total peripheral vascular resistance. A good hypotensive effect was achieved in 90.4% cases. The authors concluded that low intensity laser therapy is highly effective in stage I essential hypertension.”[36]

“Autotransfusion of laser light-irradiated blood (5-7 sessions) was found to facilitate a steady arterial blood pressure fall by an average 24% of the initial level in patients with hypertensive disease. Drop in the arterial blood pressure following the course of autotransfusion of laser light-irradiated blood was accompanied by improvement in general condition of the patients, enhancement of the effectiveness of antihypertensive preparations, favourable shifts in immunological and haemorheological indices. After discharge from hospital beneficial clinical effect persisted for up to 4-8 months. The preliminary data obtained suggest that autotransfusion of laser light-irradiated blood may well be used as adjunct to a complex of therapeutic measures to be taken to control hypertensive disease.”[37]

“Data on the influence of low-intensity infrared laser on the central and peripheral hemodynamics in 76 agricultural machine operators facing transitory arterial hypertension are presented. Analysis revealed that low-intensity laser is more effective at the early stages of cardiovascular diseases. Low-intensity infrared laser exposure of reflexogenic zones can be effectively used to correct hemodynamic disorders in subjects facing transitory arterial hypertension.”[38]

“93 patients with ischemic heart disease, 44(47.3%) of them with arterial hypertension, were exposed to laser irradiation (LI). LI was accompanied with lowering of arterial pressure, more prominent in hypertensive patients. Mechanism of the hypotensive effect of laser therapy operates largely through stabilization of the lipid bilayer of the cell membrane demonstrated on the model of erythrocyte.”[39]

“A randomized parallel study was performed to compare the antihypertensive effect of normobaric hypoxia and low energetic laser irradiation in 57 patients with essential hypertension stage I using 24-hour blood pressure monitoring. High hypotensive efficacy of both methods is demonstrated. A course of normobaric hypoxia decreased mean 24-h and mean daytime systolic and diastolic blood pressure. Low energetic laser irradiation reduced mean 24-h, mean daytime and mean night systolic and diastolic blood pressure.”[40]

“The effect of low-energy laser irradiation used as monotherapy was studied in 42 patients with early essential hypertension. Hypotensive and antioxidant effects of laser therapy, its ability to decrease total peripheral resistance were more pronounced in patients with stage I hypertension.”[41]

“The use of laser puncture allowed to reduce the dose of hypotensive drugs.”[42]

“The authors report efficacy of using laser puncture and pointed massage in controlling hypertensive crises in patients suffering of hypertensive disease. The arterial pressure was reduced mainly due to decrease of the peripheral resistance. This method of treatment was more effective in patients with moderate and significant hypertrophy of the left ventricle as compared with patients showing marked hypertrophy of the left ventricle.”[43]

“Long-term (1-1.5 years) hypotensive therapy, especially with combination of beta-blockers with diuretics, has a negative effect on blood rheology. Optimisation of EH treatment in terms of blood rheology consists in using essential phospholipids in stable hypertension, intravenous laser radiation in complicated hypertension,

plasmapheresis in drug-resistant hypertension. Such an approach not only significantly improves hemorheology but also provides good clinical and hypotensive effects in 75-80% patients.”[44]

“After receiving a course of low-intensity infrared laser radiation treatment the patients displayed positive changes in blood lipid spectrum, which was associated with improvement in microcirculation, decrease in afterload, increase in economization of heart functioning and activity tolerance. The obtained results demonstrate that the hypolipidemic effect of laser radiation is a substantial factor in the regression of CHD manifestations.”[45]

5.4 Laser therapy in hyperlipidemia

“It is safe to say that:

1. Combined laser therapy enables to avoid the intake of hypolipidemic and lipotropic agents, as in the result of treatment we observed the prolonged effect in respect of the most important, pathogenetically significant deviations of lipid metabolism: a true increase of HDL-c in the nearest catamnesis (which preserves up to 6-10 months) and decrease of LDL-c. Simultaneously we registered a true lowering of TC, TG to the norm or its upper limits. AR reduced more than 3 times and the LDL/HDL-c ratio – twice.
2. The application of a staged CLT in treatment of patients with IDDM and NIDDM enables to obtain a distinct, long-term, positive effect in respect of carbohydrate metabolism, simultaneously reducing insulin and sugarcorrecting medications dosage. It also results in microcirculation improvement.”[46]

5.5 Laser therapy in stroke

“The NeuroThera Laser System therapeutic approach involves use of infrared laser technology and has shown significant and sustained beneficial effects in animal models of ischemic stroke. CONCLUSIONS: The NEST-1 study indicates that infrared laser therapy has shown initial safety and effectiveness for the treatment of ischemic stroke in humans when initiated within 24 hours of stroke onset. A larger confirmatory trial to demonstrate safety and effectiveness is warranted.[47]

“In all three laser-treated groups, a marked and significant improvement in neurological deficits was evident at 14, 21, and 28 days post stroke relative to the non-treated group. CONCLUSIONS: These observations suggest that LLLT applied at different locations in the skull and in a rather delayed-phase post stroke effectively improves neurological function after acute stroke in rats.”[48]

6. WHAT IS THE PURPOSE OF MEDICAL SCIENCE?

Is it the thousands of pages of scientific manuscripts produced every year? Is it to develop drugs, medical devices or techniques which are profitable? Or is it to seek in service the best ways to treat and prevent disease? To achieve the greatest good for the largest number of people seems a worthwhile aim. If medicine’s purpose is to serve, then the science which supports this intention should discern and explore that which offers the greatest potential benefit.

It is time to review the ways we have been treating cardiovascular and other diseases and consider new options in light of the evidence. The methods to make health care better are available here and now. Meaningful reform may come more by adopting treatments which are cost-effective, safe and life enhancing than through

creating programs to redistribute existing care. Perhaps the economy is merely a mirror to show us where we need to go.

7. SAFETY, EFFICACY AND COST

A guiding principle in medicine historically has been **primum non nocere** – **first, do no harm**. The Hippocratic Oath states, “I will prescribe regimens for the good of my patients according to my ability and my judgment and never do harm to anyone.”[49]

If medical science is in service to people, it should also seek first to ensure safety and then to evaluate and compare all forms of treatment fairly and objectively.

Three questions medical science should undertake to answer when evaluating and comparing treatment options are:

- Is it safe?
- Is it effective?
- What is the cost?

8. LET THERE BE LIGHT IN MEDICINE

Perhaps the single reason that laser therapy holds such promise for cardiovascular disease is that it adds readily accessible energy to profoundly stimulate all activities and functions of cells, tissues and systems. Biostimulation – **Life stimulation** – and tissue regeneration are the first effects credited to laser therapy in much of what has been written about it in the literature. Consider what that suggests about laser therapy’s promise and power. How many other therapies can make such a claim?

Laser therapy has also proven to be extremely safe. No harm has been documented in forty plus years of use in research and in the clinic. Is laser therapy cost-effective? That laser therapy is documented to stimulate tissue regeneration would certainly seem to suggest so. This therapy which heals the condition for which it is applied has an end point. “Managing” a condition endlessly with pharmaceutical drugs or any method makes little sense if that problem can be resolved by other means.

Atherosclerosis, the common root of most cardiovascular disease, is caused by endothelial dysfunction within arteries. “Laser therapy can be considered an effective method of increase of endothelial functional activity in patients with stable angina pectoris.”[50] “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.”[51] This writer has personally observed several patients who had been experiencing signs and symptoms of ischemic heart disease, including angina and palpitations, report complete relief for months at a time and long-term improvement in their condition and overall general health as well.

The United States presently spends more per capita for healthcare than any other developed country yet falls far behind most nations in the health of its citizens. In fact, health care is presently the single largest sector of the U.S. economy. Could it be that the cost of medical care was the final straw, precipitating America’s recent economic tailspin?

The total cost of cardiovascular disease in the United States in 2008 has been estimated at \$448.5 billion dollars.[52] The time for retirement is upon the baby boomer generation, and the need to provide care for an aging population in ever larger numbers demands new and different technology and infrastructure. Let there be light in medicine.

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[1] American Heart Association <http://www.americanheart.org/presenter.jhtml?identifier=4478>

[2] Rosamond W, et al. Heart disease and stroke statistics 2007 update. A report from the American Heart Association Statistics Committee and Stroke Statistics Subcommittee. *Circulation* 2006; DOI: 10.1161/circulationaha.106.179918.

[3] American Heart Association <http://www.americanheart.org/presenter.jhtml?identifier=4478>

[4] American Heart Association <http://www.americanheart.org/presenter.jhtml?identifier=4478>

[5] American Heart Association <http://www.americanheart.org/presenter.jhtml?identifier=4475>

[6] From <http://inventors.about.com/library/inventors/blheartlungmachine.htm>

[7] From <http://www.ptca.org/nv/timeline.html>

[8] American Heart Association <http://www.americanheart.org/presenter.jhtml?identifier=4439>

[9] American Heart Association <http://www.americanheart.org/presenter.jhtml?identifier=4439>

[10] Gasparyan, L, "Laser Irradiation of the Blood", *Laser Partner*, 10, 1 (2003).

[11] Simunovac, Z, [Lasers in Medicine and Dentistry, Basic Science And Up-To-Date Clinical Application Of Low Energy-Level Laser Therapy] Locarno, Switzerland/Rijeka, Croatia, 279 (2000).

[12] Gasparyan, L, "Laser Irradiation of the Blood", Published jointly in *Laser Partner* www.laserpartner.org and *Laser World*, www.laser.nu, 10, 1 (2003).

[13] Rindge, D, "Laser Therapy in Cardiovascular Disease." *Acupuncture Today*, 8, 4 (2007).

[14] Kemalov R, "Effect of low-intensity laser radiation on lipid metabolism and hemostasis in patients with myocardial infarction" *Vopr Kurortol Fizioter Lech Fiz Kult.*, (2):6-8, (2006).

[15] Mirsky N, Krispel Y, Shoshany Y, Maltz L, Oron U, "Promotion of angiogenesis by low energy laser irradiation." *Antioxid Redox Signal.* Oct; 4(5), 785-90 (2002).

- [16] Oron, U, "Photoengineering of tissue repair in skeletal and cardiac muscles." *Photomed Laser Surg.* 24(2), 111-20 (2006).
- [17] Kolpakova M, Vlasov T, Petrishchev N, Vislobokov A Sechenov Ma, "Effect of the He-Ne laser irradiation on resistance of the isolated heart to the ischemic and reperfusion injury" *Russ Fiziol Zh Im I.* 89(12),1496-502 (2003)
- [18]Ad N, Oron U, "Impact of low level laser irradiation on infarct size in the rat following myocardial infarction." *Int J Cardiol.*(80)109-116 (2001).
- [19] Vasil'ev A, Strel'tsova N, Senatorov I, "Laser irradiation in the treatment of ischemic heart disease" *Vopr Kurortol Fizioter Lech Fiz Kult.* ((6):10-3 (2001)
- [20] Burduli N, Gazdanova A, "Laser Doppler fluometry in assessment of endothelium state in patients with coronary heart disease and its correction by intravenous laser irradiation of blood" *Klin Med (Mosk)* 86(6), 44-7 (2008).
- [21] Volotovskaia A, Ulashchik V, Filipovich V, "Antioxidant action and therapeutic efficacy of laser irradiation of blood in patients with ischemic heart disease." *Vopr Kurortol Fizioter Lech Fiz Kult»* (« »). (3):22-5 (2003).
- [22] Zin'kovskaia T, Zavrazhnykh L, Golubev A, "Use of infrared laser therapy in patients with ischemic heart disease associated with diabetes mellitus type 2 in health resort." *Vopr Kurortol Fizioter Lech Fiz Kult,* (4):9-11, (2002).
- [23] Vasil'ev A, Strel'tsova N, "The dynamics of the clinico-functional indices in patients with ischemic heart disease under the influence of repeated courses of laser therapy." *Vopr Kurortol Fizioter Lech Fiz Kult.* (5):9-11 (1997).
- [24] Budnar' L, Antiuf'ev V, Oranskii I, Bekhter T, "The effect of exposure to magnetics and lasers on the clinical status and the electrophysiological indices of the heart in patients with cardiac arrhythmias." *Vopr Kurortol Fizioter Lech Fiz Kult.*(2):5-8 (1996),
- [25] Korochkin I, Kapustina G, Babenko E, Zhuravleva N, "Helium-neon laser therapy in the combined treatment of unstable stenocardia." *Sov Med.* (. »).-(3)12-5 (1990).
- [26] Gavrishcheva I, Dutkevich I, Pleshakov V, Kolesnik V, "The effect of different methods of photohemotherapy on the rheological properties of the blood in patients with ischemic heart disease." *Vestn Khir Im I I Grek.*(.)- 159 (2):60-4 (2000).
- [27] Siuch N, Illarionov V, "The effect of different types of laser therapy on the reactivity of the peripheral blood neutrophils in patients with ischemic heart disease." *Vopr Kurortol Fizioter Lech Fiz Kult.* (1):5-7 (1995).
- [28] Gel'fgat E, Samedov R, Kurbanova Z, Gadzhiev G, "Changes in central hemodynamics and microcirculation during laser therapy in patients with coronary insufficiency." *Kardiologiya.* 33(2), 22-3 (1993).
- [29] Kniazeva T, Badtieva V, Zubkova S, "The laser therapy of patients with hypertension in combination with coronary insufficiency." *Vopr Kurortol Fizioter Lech Fiz Kult.* (2):3-5 (1996).

- [30] Iaitskii N, Ageenko E, Davydenko T, Volchkov V, Churzin O, Zharskaia V, "Intravascular laser irradiation of blood in complex treatment of obliterating atherosclerosis of the lower extremity vessels in elderly and senile patients" 165(4), 34-7 (2006).
- [31] Lipatova I, Arslanova V, Kriuchkov V, Markov A, Sakharov A, "Low-intensive laser irradiation in combined treatment of lower limbs atherosclerotic lesions." *Khirurgiia Mosk* ().-(4), 14-9 (2003).
- [32] Klimenko I, Shuvalova I, "Low intensity laser radiation in complex therapy of patients with vascular obliterating atherosclerosis of low extremities" *Lik Sprava*. (8), 98-102 (2002).
- [33] Leont'eva N, Evdokimova T, Sedletskaia Elu, Dmitrieva Ia, Zolotnitskaia V, "Supravascular laser exposure in combined modality treatment of patients with arteriosclerosis obliterans of blood vessels of lower extremities." *Vopr Kurortol Fizioter Lech Fiz Kult*. (3), 5-7 (2001).
- [34] Shval'b P, Zakharchenko A, Sigaev A, Kataev M, "Intravenous laser irradiation of the blood in occlusive vascular diseases of the extremities." *Sov Med*.(3):21-3 (1990).
- [35] Korkushko O, "Effect of infrared laser irradiation on the arterial blood pressure in liquidators of the accident at the Chernobyl power plant." *Fiziol Zh.*, (. . .).-49(1):104-8 (2003).
- [36] Velizhanina I, Gapon I, Shabalina M, Kamalova N, *Klin Med (Mosk)*, "Efficiency of low-intensity laser radiation in essential hypertension", 79 (1), 41-44, (2001).
- [37] Alizade I, Karaeva N, "Experience in the use of autotransfusions of laser-irradiated blood in treating hypertension patients." *Lik Sprava*, (5-6), 29-32 (1994).
- [38] Mokretsov V, Utts S, "The correction of hemodynamic disorders with low-intensity infrared laser radiation in agricultural machinery operators with borderline arterial hypertension." *Gig Tr Prof Zabol*. (4), 32-3 (1992).
- [39] Vasil'ev A, Strel'tsova N, "A possible mechanism of the hypotensive effect of laser irradiation in patients with ischemic heart disease with arterial hypertension." *Vopr Kurortol Fizioter Lech Fiz Kult*. (5), 17-20, 2001.
- [40] Velizhanina I, Evdokimova O, "Evaluation of the effectiveness of normobaric hypoxia and low-intensity laser radiation in hypertensive patients from 24-hour arterial pressure monitoring data." *Vopr Kurortol Fizioter Lech Fiz Kult*, (1):15-8 (2001).
- [41] Velizhanina I, Shabalina M, Gapon LI, Kamalova N, Sergeichik O, "The laser therapy of hypertension patients in the initial stages." *Vopr Kurortol Fizioter Lech Fiz Kult*. (1), 9-11 (1998).
- [42] Odud A, Potapenko P, "The effectiveness of laser puncture in hypertension patients." *Vrach Delo*.(6):19-21 (1990).
- [43] Odud A, Potapenko P, "The effectiveness of laser puncture in hypertension patients." *Vrach Delo*. (6),19-21 (1990).
- [44] Shabanov V, Terekhina E, Kostrov V, "Changes in blood rheological properties in patients with hypertension." *Ter Arkh*. 73(10), 70-3 (2001).

[45] Vasil'ev A, Sekisova M, Strel'tsova N, Senatorov I, "Laser correction of microcirculation disorders in patients having CHD with hypercholesterinemia." *Klin Med (Mosk)*. 83(2), 33-7 (2005).

[46] T Kovalyova, "Ambulatory Application of Combined Laser Therapy in Patients with Diabetes Mellitus and Dyslipidemia" *Laser Partner*, 17, 5 (2002).

[47] Lampl Y, Zivin J, Fisher M, Lew R, Welin L, Dahlof B, Borenstein P, Andersson B, Perez J, Caparo C, Ilic S, Oron U, "Infrared laser therapy for ischemic stroke: a new treatment strategy: results of the NeuroThera Effectiveness and Safety Trial-1 (NEST-1)" *Stroke*. Jun, 38(6), 1843-9. Epub 2007 Apr 26 (2007).

[48] Detaboada L, Ilic S, Leichliter-Martha S, Oron U, Oron A, Streeter J, "Transcranial application of low-energy laser irradiation improves neurological deficits in rats following acute stroke", *Lasers Surg Med*. Jan, 38(1), 70-3 (2006).

[49] From http://en.wikipedia.org/wiki/Hippocratic_Oath

[50] Budnar' L, Antiuf'ev V, Oranskii I, Bekhter T, "The effect of exposure to magnetics and lasers on the clinical status and the electrophysiological indices of the heart in patients with cardiac arrhythmias." *Vopr Kurortol Fizioter Lech Fiz Kult*.(2):5-8 (1996),

[51] Vasil'ev A, Strel'tsova N, "The dynamics of the clinico-functional indices in patients with ischemic heart disease under the influence of repeated courses of laser therapy." *Vopr Kurortol Fizioter Lech Fiz Kult*. (5):9-11 (1997).

[52] American Heart Association <http://www.americanheart.org/presenter.jhtml?identifier=4475>

[1] Laser therapy is the most popular term for the therapeutic application of laser light at low intensity. Laser therapy is generally given at gentle, non-ionizing wavelengths within the red to near-infrared portion of the spectrum and at modest output powers below the threshold of heat damage to tissue.

[1]

[2] "Low level laser therapy," "low intensity laser therapy," "laser photobiostimulation" and "low power laser therapy" are a few of the other terms which have been used. Recently "laser phototherapy" has been proposed as a more accurate way to differentiate this method from surgical or other high powered laser treatment.

[2] " ()," " ()," " "

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