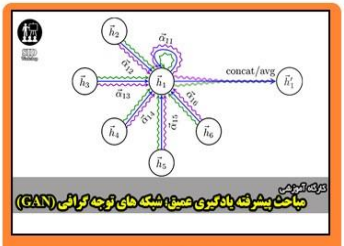
کارگاه های آموزشی مرکز اطلاعات علمی جهاد دانشگاهی

کارگاه آنلاین آشنایی با پایگاه های اطلاعات علمی
بین المللی و
ترفند های جستجو



مباحث پیشرفته یادگیری عمیق؛
شبکه های توجه گرافی
(Graph Attention Networks)

کارگاه آنلاین مقاله نویسی IEEE و ISI
ویژه فنی و مهندسی

Review Article

The Intravenous Laser Blood Irradiation in Chronic Pain and Fibromyalgia

Sirous Momenzadeh[1], Mohammadzaki Abbasi[2*], Asghar Ebadifar[3], Mohammadreza Aryani[1], Jafar Bayrami[1], Fatemeh Nematollahi[1]

[1]Laser Application in Medical Sciences Research Center, Shahid Beheshti University of Medical Sciences, Tehran, Iran
[2]Shohadaei Khalije Fars Hospital, Bushehr University of Medical Sciences, Boushehr, Iran
[3]Dentofacial Deformities Research Center, Shahid Beheshti University of Medical Sciences, Tehran, Iran

Abstract:

Intravenous laser blood irradiation was first introduced into therapy by the Soviet scientists EN.Meschalkin and VS.Sergiewski in 1981. Originally this method was developed for the treatment of cardiovascular diseases. Improvement of rheologic properties of the blood as well as improvement of microcirculation and reduction of the area of infarction has been proved. Further, reduction of dysrhythmia and sudden cardiac death was achieved. At first, only the Helium-Neon laser (632.8 nm) was used in this therapy. For that, a power of 1-3mW and a period of exposure of 20-60 minutes were applied. The treatments were carried out once or twice a day up to ten appointments in all1. In the years after, many, and for the most part Russian studies showed that helium-neon laser had various effects on many organs and on the hematologic and immunologic system. The studies were published mainly in Russian which were little known in the West because of decades of political separation, and were regarded with disapproval. Besides clinical research and application for patients, the cell biological basis was developed by the Estonian cell biologist Tiina Karu at the same time. An abstract is to be found in her work "The Science of Low-Power Laser-Therapy"

Keywords: laser; pain; irradiation

Please cite this article as follows:
Momenzadeh S, Abbasi M, Ebadifar A, Aryani M, Bayrami J, Nematollahi F. The Intravenous Laser Blood Irradiation in Chronic Pain and Fibromyalgia. J Lasers Med Sci 2015;6(1):6-9

Corresponding Author: Mohammadzaki Abbasi, MD; Shohadaei Khalije Fars Hospital, Bushehr University of Medical Sciences, Boushehr, Iran.Tel:+982188430922 ; Fax:+982188449342 ; E-mail: smomenzadeh@sbmu.ac.ir

Effects and mode of operation of intravenous Low-Level-Laser-Therapy of the blood

1. Under laser blood irradiation, anti-inflammatory effects were observed that improved the immunologic activity of the blood[1].

2. A fundamental finding was the positive influence on rheological properties of the blood which is of greatest interest to surgery, angiology and cardiology in particular[2]. A diminishing tendency of aggregation of thrombocytes and an improved deformability of erythrocytes result in an improved oxygen supply and with that to a decrease of partial carbon dioxid pressure, which is particularly relevant to wound healing[3]. Furthermore, the activation of phagocytic activity of macrophages was proved in conjunction with structural modifications. A positive effect on the proliferation of lymphocytes and B- and T-cell-subpopulations could be verified too[4].

3. The hypoxia of the tissue is improved which leads to a normalization of the tissue metabolism. In addition the fibrinolysis will be activated. Apart from the elimination of hypoxia and the normalization of tissue metabolism an increase of ATP-synthesis occurs with a normalization of cell membrane potential. Additional vasodilatation is leading to de-blocking of capillaries and collateral vessels in connection with the described improved rheological properties of the blood together

with an improved trophicity of tissues and normalization of neurosensory stimulation. The increased release of NO from monocytes obviously is of critical importance. Because of the described effects the intravascular blood-irradiation is used in Russian surgical university-clinics preoperatively to avoid thromboembolic complications, and improve postoperative wound healing.

In addition there are laser specific analgesic, spasmolytic and sedative effects.

There are reports on patients with chronic glomerulonephritis who had significant improvement of tolerability of medication (glucocorticoids.cytostatic drugs, diuretics) and of kidney function. In the same way an improvement of inflammation parameters in acute pyelonephritis could be shown. In necrotising pancreatitis, an improvement of blood lab values and of the immunological parameters has been proved too[5].

4. Intravenous blood irradiation was widely used in obstetrics and gynecology to stimulate utero-placental blood exchange and as prophylaxis and therapy of inflammations of the interior genitals.

5. Furthermore it was observed that mitochondria changed to so called "giant mitochondria" after laser-irradiation with activation of various metabolic pathways and increased production of ATP. The electron microscopy of "giant mitochondria" revealed intracellular annular structures. These mitochondrial changes cannot be compared with pathological giant mitochondria as they appear in certain clinical syndromes. In these syndromes we can observe pathological swelling of the organelles and deposit of pathological paracrystalline albumins leading to specific myopathies. The structure of mitochondria may vary strongly according to the type of cell. They can impress as sausage shaped organelles, but may also appear as a highly branched intercommunicating tubular network. Observations of fluorescence marked mitochondria in living cells have shown that they are dynamic and may vary their shape strongly. Above all it is important that mitochondria may merge with each other, or divide themselves. Probably, the balance between fusion and division is decisive for the shape and form of a mitochondrion. It was shown in histological researches on helium-neon laser irradiated lymphocytes that by development of so called giant forms the number of mitochondria was diminishing simultaneously, but the total volume was unchanged. It was detected that the cause of the development of "giant mitochondria" was a fusion of smaller mitochondria[6]. Manteifel and Karu proved big branched forms of mitochondria in germinating yeast cells, but after laser-irradiation an expansion of the tubular network developed without damaging the organelles[3]. These mitochondria are marked by a relative enlargement of surface of the mitochondrial cristae due to activation of the respiratory chain and ATP-synthesis. It has to be mentioned that the description of the development of mitochondria to giant mitochondria is discussed controversially.

Heine is pointing out that there is no evidence that such pathological forms of mitochondria will lead to an activation of varied metabolic pathways ways leading to an increase of ATP-production. Heine described the way of reproduction of mitochondria in 1979: Whenever there is a need of additional ATP they will divide, but not fuse with each other[7].

Obviously there seems to be generalized effects of the intravenous blood-irradiation on almost every organ system so that this therapy may be employed in the treatment of various diseases causally or additively. Gasparyan described[4] the improvement of microcirculation especially in central nervous structures. In particular, this is most important in the hypothalamus which has a highly developed vascular micro system. He assumes that the intravenous blood-irradiation is stimulating the functional activity of the hypothalamus and limbic system leading to an activation of hormonal, metabolic, immunological and vegetative processes with mobilization of adaptive reserves.

Intravenous laser blood irradiation is carried out with low power of 1-3 mW and an exposure time of 20-60 minutes. A series of 10 treatments will be carried out either every day or three times a week with a weekend break.

For intravenous laser blood irradiation first of all you have to feed in a cannula into a suitable vein of the elbow or the forearm. The vein should have a wide lumen to catch a great volume of blood in the period of time. In the Russian studies a simple steel-cannula was inserted, in which a disposal laser plastic-catheter was fed in and was connected to a laser diode. This procedure was modified by the author by feeding in a blue plastic cannula for children (Braun Medical, Melsungen)[6] into a suitable vein and then a newly developed disposable laser-catheter made of biological compatible plastic material is inserted into the vein. With veins that are difficult to puncture or if there is lack of practice, the setting of the cannula may cause problems, but recently a suitable little butterfly was developed which permits an easy application of the above described catheter. The advantage of this therapy is that it can be learned by an assistant or a nurse, so the doctor has not to be right

next to the patient all the time[8].

Up to now it was believed that especially irradiation in the red range was particularly effective due to the absorption spectrum of cytochrome-C-oxidase in the respiratory chain with a stimulation of the ATP-synthesis. The originally Russian studies[7] were all carried out with red light laser of the wavelength 632, 8 nm of the helium-neon-laser because in the beginning there was no laser in the shorter wave range (green or blue) available. Because the red light is not absorbed by the erythrocytes, when red laser light is conducted into the bloodstream, the vein lights up in bright red. So actually it should make sense to use complementary green laser light for laser blood irradiation as well[9]. When green laser light is conducted into a vein you practically will not see any green shining through the skin since the "red" erythrocytes are absorbing green light virtually completely. This therapy was introduced by the author for the first time to laser blood irradiation and many of the patients treated with red laser light were treated with green laser once more, and the results were compared with red light laser. On that occasion it turned out that the green laser causes corresponding stimulations too and obviously reacts on various parameters in a different way or better than the red light laser. In a third cycle some of the patients were treated then with a combination of red and green laser - with the idea to stimulate the leucocytes initially with the red laser and to load energy on the erythrocytes with the green laser[10]. Then it turned out that the combination of both types of laser obviously reveal the best possible effect. These results represent however just first impressions and they have to be investigated further intensively to obtain valid data. Reviewing the latest literature, it comes out that the green laser was also tested in the irradiation of blood by other scientists recently. In an article (2004), blood cells were irradiated in vitro with the wavelength 632, 8 nm (helium-neon laser) and 532 nm (green laser). In these experiments it could be shown that the green laser had an advantage on rheologic properties of the blood by an improved deformibility of erythrocytes[11]. The corresponding absorption spectrum for hemoglobin was assumed as cause for the green laser effect in particular. In a recent work of Kassak and colleagues of Bratislawa University, Slovakia, in cooperation with the department of General Biophysics of Lodz University, Poland[12], the effect of green laser light on Na-Ka-ATPase was investigated. A distinct stimulating effect of the green laser light on the activity of the erythrocyte Ka-Na-ATPase was shown. These latest findings are of exceptional significance. Previous explanatory models of the photobiochemical energy transfer model followed the mitochondrial structures and the electron carrier systems in the respiratory chain, but these do not exist in erythrocytes. According to previous ideas, absorption of green laser photons to the erythrocytes would be only transferred into a local warming up. The evidence of an increased Na-Ka-ATPase permits the conclusion that besides the warming up; also, structural molecular changes are activated with triggering of specific biochemical activity. So the membranous lipid layers can also change. In another work from Vinck and colleagues[9] of the department anatomy, embryology and histology of the Universiry of Ghent, Belgium, it could be shown in April 2005 that under green light irradiation it comes to an increase of fibroblast proliferation with an improved effect on glucose metabolism. It must be emphasized here again that the described works on green laser so far were exclusively in-vitro-experiments. The first human investigations with green light laser blood irradiation were made by the author himself and have been described in this presented work here for the first time[13].

Conclusion

The current procedures to treat chronic pain and fibromyalgia primarily consist of medication, physiotherapeutic and psychological therapeutic forms, which cannot always achieve a significant reduction of the symptoms; however, from experience, they mostly prevent aggravation. According to the classical Chinese model, the needle acupuncture treatment represents another option to limit the individual symptoms. By observing the individual patient groups, however, a slightly limited tolerability of the pain stimuli associated with the application was often produced. According to references as well as the very needle treatment experiments, even better results are achieved in a comparative manner and to a certain extent by using laser needle acupuncture treatment. The intravenous blood irradiation using red light and green lasers has also been capable of accomplishing a significant improvement in the symptoms of the condition affecting the patients. This is especially demonstrated in the general well-being, which improved by approximately a factor of 3. An energetic concentration of the cell lines present in blood and the accompanying improvement and acceleration of ADP conversion to ATP seems to have considerable effects both in the muscular system as well as in other different factors. The observations presented in this work

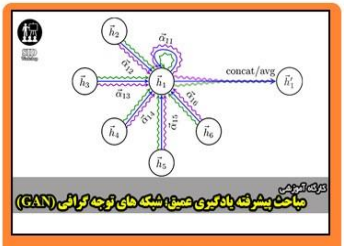
do not fulfil the prerequisites for a controlled application observation or for a treatment study. However, they show a significantly positive trend for a clinical record that is only otherwise difficult to treat. Therefore, the contents of further studies are required for the processing of a stringently prospective representation in the treatment process of fibromyalgia using controlled methods.

References

1. Bakeeva L, Manteiffel V, Rodichev E, Karu T. Formation of gigantic mitochondria in human blood lymphocytes under the effect of an He-Ne laser. Mol-Biol-Mosk. 1993; 27 (3):608-17
2. Bodenburg R. Laser needle-acupuncture and intravascular laser blood-irradiation from a legal point of view. Pain Acupunct. 2007; 33, 1:42-8.
3. Boev S, Selivonenko V. The impact of the intravenous He-Ne-Laser therapy on the antioxidant system in patients with stable insertion angina and postinfarkt cardiosclerosis. Klin-Med-Mosk. 1997; 75, 12:30-3.
4. Brill G, Grigoriev S, Romanova T. Changes of leucocyte metabolism in He-Ne laser blood irradiation in vitro. Proc SPIE. 1993; 1981:204-9.
5. Dimitriev A, Iudin V, Aparov N, Matyrnov V. Effect of intravascular laser irradiation of the blood on blood cells in pancreatitis. Klin Med (Mosk.). 1989; 67, 5:108-10.
6. Driianskaia V. The clinico-immunological effects of immunotherapy in patients with acute pyelonephritis. Lik-Sprava. 1997;(4):89-92.
7. Dube A, Hausal H, Gupta PK. Modulation of macrophage structure and function by low level He-Ne irradiation. Photochem. Photobiol. Sci. 2003; 2(8):851-5.
8. Frick G, Dehmlow R. Practice Guideline UVBund HOT. Fundamentals and use of stimulus-reaction-therapy. Stuttgart: Hippokrates. 2001:77-9.
9. Funk J, Kruse A, Kirchner H. Cytokine production after helium-neon laser irradiation in cultures of human peripheral blood mononuclear cells. J Photochem. Photobiol. 1992; 16, 3-4: 347-55.
10. Gasparyan L. Laser Irradiation of the blood. Laser Partner-Clinixperience – First volume 2003:1-4.
11. Grubnik V, Dotsenko S, Chuev P, Basenke I, Salemekh A. Laser in the prevention of early postoperative complications in the surgical treatment of obesity. Klein-Khir. 1994; 8:25-7.
12. Gulsoy M, Ozer G, Bozkulak O, Tabakoglu H, Aktas E, Deniz G, et al. LLLT increases lymphocyte proliferation. J Photochem. Photobiol. 2006; 82, 3:199-202.
13. Gür A, Karaçoc M, Nas K, Cevik R, Sarac A, Ataoglu S. Effects of low power laser and low dose amitryptiline therapy on clinical symptoms and qualità of life in fibromyalgia: a single-blind, placebo-controlled trial. Rheumatol Int. 2002; 22, 5:188-93.

کارگاه های آموزشی مرکز اطلاعات علمی جهاد دانشگاهی

کارگاه آنلاین آشنایی با پایگاه های اطلاعات علمی
بین المللی و
ترفند های جستجو



مباحث پیشرفته یادگیری عمیق؛
شبکه های توجه گرافی
(Graph Attention Networks)

کارگاه آنلاین مقاله نویسی IEEE و ISI
ویژه فنی و مهندسی