**DOI: 10.26693/jmbs07.04.031**
**UDC 616.58:619.11-004.63.044**
***Abbasaliyev B. B.***

# TROPHIC ULCERS OF THE LOWER EXTREMITIES: POSSIBILITIES OF CONSERVATIVE TREATMENT

**Azerbaijan Medical University, Baku, Azerbaijan**

*The purpose of the study* was to evaluate the effectiveness of low-intensity laser radiation in the complex treatment of trophic ulcers of the lower extremities in patients with varicose veins based on objective criteria.

*Materials and methods.* Clinical and histomorphological studies were performed on patients aged 15 to 75 years who were treated for small and medium stage II ulcers on the lower extremities at the Training and Surgical Clinic of the Azerbaijan Medical University and the Central Hospital of the Gazakh region. The criteria for inclusion in the study were men and women of the above mentioned age, and the presence of ulcerative necrotic lesions of the lower extremities. The exclusion criteria were heart failure, systemic diseases, oncological diseases, hormone therapy, and pregnancy. The patients included in the study groups were comparable in age and sex characteristics, the volume of ulcerative lesions of the lower extremities, the duration of the disease and the somatic state. In the main group, in the treatment of trophic ulcers of the lower extremities of small and medium sizes, Venocoryl ointment, low-intensity laser radiation and endovenous laser ablation using a modified ptfe-coated cylindrical light guide were used. The control group included 25 patients, in whose regional treatment only standard retro-specific methods of treatment using endovenous laser ablation were used. The comparison group included 25 patients who underwent endovenous laser ablation and were prescribed Venocoryl ointment. The experimental groups included 21 men and 54 women aged 15 to 75 years.

*Results and discussion.* The rate of healing of trophic ulcerative wounds during the second month after the start of therapy in the main group in patients of the main group was 0.131 ± 0.008 $cm^2$ per day, in the comparison group – 0.125 ± 0.007 $cm^2$; in the control group – 0.072 ± 0.004 $cm^2$ per day. When observing patients for up to 6 months, the following was noted: in the main group, after the application of the laser, it was possible to completely heal the wound defect in 21 patients (84%) in the main group, 17 patients in the comparison group (68%) and 13 patients in the control group (52%). In the course of the research, it was found that in the main group for the first month there is an active process of epithelization and a reduction, against this background, of the ulcer, and, despite the decrease in the rate of reparative processes in this group, the ulcer epithelializes much earlier and faster.

*Conclusion.* The high rate of healing with the use of laser radiation, compared with standard treatment, was maintained throughout the study period.

**Keywords**: varicose veins, trophic ulcer, treatment, rate of epithelialization.

**Introduction.** Varicose veins of the lower extremities are a widespread pathology, especially among representatives of both sexes aged 25–50 years, that is, in the most socially active part of the population, and more than 15% of cases have severe forms of the disease with pronounced trophic and recurrent ulcers [1, 2, 3]. Adequately selected therapeutic and preventive methods and means play a very important role in solving this urgent problem for modern medicine. Now patients have begun to pay more attention to aesthetic aspects, which is achieved by the introduction of minimally invasive techniques [4, 5, 6]. This forces specialists to resort to new methods of surgical treatment, in particular, endovenous laser obliteration, which, in addition to a good cosmetic result and the possibility of outpatient use, is characterized by a low risk of complications [7, 8]. Currently, high-tech dressing materials are used in practice to accelerate the healing of chronic wounds, but only after preliminary treatment of the wound or the bottom of the ulcer to remove purulent necrotic masses, and after cleansing the wound many methods and means are proposed to stimulate reparative processes, among which collagen preparations, concentrated platelet suspension can be shown [9].

It should be noted that regardless of the etiological causal factors of the occurrence of wounds,

modern principles of regional impact on them and treatment of varicose veins are based on complex treatment using both conservative and classical surgical and intravascular, that is, invasive, minimally invasive surgical methods. At the same time, the basis of all types of surgical interventions is the removal of varicose altered pathological tissues and the complete elimination of the pathological process. It is possible to point out some disadvantages of surgical intervention, in particular, traditional phlebectomy – that is a high traumatism, an increase in the duration of hospitalization or hospital bed days, which, in turn, negatively affects the entire postoperative period and the course of medical and social rehabilitation of patients [10, 11].

**The purpose of the study** was to evaluate the effectiveness of low-intensity laser radiation in the complex treatment of trophic ulcers of the lower extremities in patients with varicose veins based on objective criteria.

**Materials and methods**. Clinical and histomorphological studies were performed on patients aged 15 to 75 years, treated for small and medium stage II ulcers on the lower extremities in the Educational and Surgical Clinic of the Azerbaijan Medical University and the Central Hospital of the Gazakh district. The criteria for inclusion in the study were men and women of the above mentioned age, and the presence of ulcerative necrotic lesions of the lower extremities. The exclusion criteria were heart failure, systemic diseases, oncological diseases, hormone therapy, and pregnancy. The patients included in the study groups were comparable in age and sex characteristics, the volume of ulcerative lesions of the lower extremities, the duration of the disease and the somatic state.

The study was carried out in compliance with the basic provisions of the "Rules of ethical principles of scientific medical research with human participation", approved by the Declaration of Helsinki (1964-2013), ICH GCP (1996), EEC Directive No. 609 (dated 24.11.1986). All the participants were informed about the goals, organization, methods of examination and signed an informed consent to participate in the completely anonymous study.

To conduct a comparative analysis, patients were randomly divided into three groups: the main group, the comparison group and the control group. 25 patients were included into each group, in the local treatment of whom various methods and means of treatment were used. In the main group, Venocoryl ointment, low-intensity laser radiation and endovenous laser ablation using a modified cylindrical fiber with ptfe-coating (EVLA) were used in the treatment of trophic ulcers of the lower extremities of small and medium sizes. The control group included 25 patients, in whose regional treatment only standard retro-specific methods of treatment with the use of EVLA were used. The comparison group included 25 patients who underwent EVLA and were prescribed Venocoryl ointment. The experimental groups included 21 men and 54 women aged 15 to 75 years (**Table 1**).

**Table 1** – Age-sex indicators of the examined patients (%)

| Age (15–75) n= 75 | Gender | |
|---|---|---|
| | Male | Female |
| 15–35 | 7 (33%) | 11 (20%) |
| 36–55 | 9 (43%) | 19 (35%) |
| 56–75 | 5 (24%) | 24 (45%) |
| Total | 21 (28%) | 54 (72%) |

The study of trophic ulcers determined the number, localization, depth and magnitude of ulcers.

Clinical indicators of regeneration included the number of granulations and marginal epithelization:

0 – their absence;

1 – fine-grained (single) granulations and poorly expressed marginal epithelization;

2 – coarse-grained multiple granulations and a distinct border of marginal epithelization.

Based on a dynamic study of the area of a trophic ulcer, its healing rate was calculated using the formula Vs = (S-Sn) / t, using the technique of Popova L. N., where S is the area of the ulcer before treatment, Sn is the area during subsequent measurements, t is the number of days between measurements. To determine the area of the ulcer by digital photography, followed by a similar computer calculation of the defect areas, an iPhone application program – LesionMeter was used.

The obtained results were statistically processed with a comparison of the average values (M±m) of the epithelialization rate of the groups. The reliability of the differences was determined using the nonparametric Wilcoxon-Mann-Whitney criterion. The analysis was carried out using Statistica 10.0 and MicrosoftExcel 2007 programs. The values of $p<0.05$ were assumed to be reliable.

**Results and discussion**. In all patients, as a manifestation of varicose veins, there was an ulcerative defect of the skin and soft tissues on the lower limb (trophic ulcer), existing from the appearance of the first clinical symptoms to the doctor's appointment for more than 6 weeks. The criteria for inclusion of patients in the study were: patients of both sexes older than 18 years, who, according to clinical and instrumental examination, have ulcerative defects that do not extend to bones, muscles, tendons, voluntary informed written consent of all patients to participate in the study.

In most cases, ulcerative defects were 4–7 $cm^2$ in area. The complex of clinical evaluation of the

effectiveness of the applied treatment methods included the following criteria: reduction of the size of the wound surface, as well as the onset of marginal epithelialization and its rate. The revealed statistical data show that wound cleansing and reparative processes, when using laser radiation at certain stages of observations, were more pronounced and faster than against the background of traditional therapy, that is, in the control group and in the comparison group. At the same time, it should be noted that in this group there were practically painless manipulations that were not accompanied by trauma of the young granulation tissue. The dynamics of the healing rate of purulent-necrotic wounds in all groups of patients is presented in **Table 2**. At the initial stage, the average healing rate of trophic ulcers was higher in the comparison group compared to the main group, but there was no significant difference between the two groups compared (p = 0.5266).

Statistically significant differences in the studied groups at this stage were characterized by the indicators recorded in the main and control groups (p = 0.0001). When assessing the course of the wound process during therapeutic and preventive measures, the rate of wound healing per day in patients with the inflammatory process in the main group during the first week was 0.125 ± 0.009 $cm^2$, in the control group – 0.065 ± 0.005 $cm^2$, and the rate of reduction of the area of ulcers in the comparison group − 0.133 ± 0.009 $cm^2$ per day. In the main group, against the background of the appearance of single granulations and the formation of a thin film over the entire surface of the wound in the early regenerative period, active marginal epithelization was observed more pronounced than in other groups.

**Table 2** – Indicators of the healing rate of trophic ulcers in groups of patients at early stages (M± m)

| Patient groups | Average epithelialization rate, $cm^2$ per day |
|---|---|
| Main group (n=25) | 0.125 ± 0.009<br>$P_{comp.}$ = 0.5266<br>$P_{cont.}$ = 0.0001 |
| Comparison group (n=25) | 0.133 ± 0.009<br>$P_{cont.}$ = 0.0001 |
| Control group (n=25) | 0.065 ± 0.005 |

***Note:*** P is the statistical significance of the difference (Mann-Whitney U-criterion).

The rate of healing of trophic ulcers by the end of the first month in the main group was 0.239 ± ± 0.010 $cm^2$ per day, in the comparison group – 0.152 ± ± 0.009 $cm^2$; in the control group – 0.068 ± 0.005 $cm^2$ per day (p = 0.0001), that is, the average rate of healing of trophic ulcers in the main group during the first month after the start of use in the combined treatment of low-intensity laser radiation was significantly higher, compared with the baseline values and compared with other groups (**Table 3**). At the same time, in the comparison group (p = 0.11234) and in the control group (p = 0.6954), the healing rate indicators did not significantly differ from the initial values.

**Table 3** – Wound healing rate in patient groups during the first month of observation (M±m)

| Patient groups | Average epithelialization rate, $cm^2$ per day | $P_{init.}$ |
|---|---|---|
| Main group (n=25) | 0.239 ± 0.010<br>$P_{comp.}$ = 0.0001<br>$P_{cont.}$ = 0.0001 | 0.0001 |
| Comparison group (n=25) | 0.152 ± 0.009<br>$P_{cont.}$ = 0.0001 | 0.1234 |
| Control group (n=25) | 0.068 ± 0.005 | 0.6954 |

***Note:*** P is the statistical significance of the difference (Mann-Whitney U-criterion).

The healing rate of trophic ulcerative wounds during the second month after the start of therapy in the main group of patients was 0.131 ± 0.008 $cm^2$ per day, in the comparison group – 0.125 ± 0.007 $cm^2$; in the control group – 0.072 ± 0.004 $cm^2$ per day (**Table 4**). Thus, during the second month after the application of the proposed treatment regimens for trophic ulcers of the lower extremities, significant differences in indicators were revealed, and the rate of repair after the use of laser radiation was significantly higher than when using traditional techniques (p = 0.0001). At the same time, in patients of the control group, the healing rate remained at a low level as for the same period.

It is important to note that in the main group there was more accelerated healing of trophic ulcers, compared with standard methods of treatment, both in the first month and in the following. Here, trophic ulcers were filled with granulation tissue more intensively, edema, hyperemia, tissue infiltration decreased more pronounced by the specified time, and marginal epithelization began to be fixed relatively earlier. Consequently, when using a low-intensity laser as a maintenance therapy, the duration of treatment of ulcers is significantly reduced. At the final stage, the healing rate relative to the beginning of treatment in almost all groups, with the exception of the comparison group, increased, while the indicators were statistically insignificant (p>0.05). Thus, the combination of local treatment, supplemented by the use of laser radiation, had a positive effect on the healing rate of trophic ulcers of the lower extremities and surpassed other methods of existing basic therapy in terms of indicators.

**Table 4** – Indicators of the healing rate of ulcers in the examined groups of patients during the second month of observation (M±m)

| Patient groups | Average epithelialization rate, $cm^2$ per day | $P_{init.}$ |
|---|---|---|
| Main group (n=25) | 0.131 ± 0.008<br>$P_{comp.}$ = 0.5583<br>$P_{cont.}$ = 0.0001 | 0.6181 |
| Comparison group (n=25) | 0.125 ± 0.007<br>$P_{cont.}$ = 0.0001 | 0.4632 |
| Control group (n=25) | 0.072 ± 0.004 | 0.2922 |

***Note:*** P is the statistical significance of the difference (Mann-Whitney U-criterion).

When monitoring patients for up to 6 months, the following was noted: after laser application, the wound defect was completely healed in 21 patients of the main group (84%), 17 patients of the comparison group (68%) and 13 patients of the control group (52%) (**Table 5**). In the course of research, it was revealed that in the main group, during the first month there is an active process of epithelialization and reduction, against this background, of the ulcerative defect, and despite the decrease in the rate of reparative processes in this group, the ulcerative defect epithelizes much earlier and faster.

**Table 5** – Cases of complete healing of ulcers in groups of patients 6 months after the start of complex treatment

| Patient groups | Fully healed wounds | Total (n=75) |
|---|---|---|
| Main group (n=25) | 21 (84%) | 51 (68%) |
| Comparison group (n=25) | 17 (68%) | |
| Control group (n=25) | 13 (52%) | |

In the main group, the time of complete healing of trophic ulcers was shorter, and the percentage of fully healed ulcers was higher than in the other two groups, which proves the pronounced reparative potential of this treatment technique.

Thus, despite the variety of tools used andnot always desired result, it is very important to know and master these techniques, as well as to develop and use their effective combinations [12, 13]. In this regard, the introduction of new means of local treatment, scientific research and the identification of new data on the healing process of trophic ulcers against the background of their use make it possible to search for rational and the most optimal methods of treatment.

**Conclusion.** A high rate of healing with the use of laser radiation has been proven, compared with standard treatment, which was maintained throughout the entire period of research.

**Perspectives for further research**. It is planned to further search for rational and the most optimal methods of treatment of trophic ulcers.

## References


1. Ahmed, WUR, Kleeman S, Ng M. Genome-wide association analysis and replication in 810,625 individuals with varicose veins. *Nat Commun*. 2022;13:3065. PMID: 35654884 PMCID: PMC9163161. doi: 10.1038/s41467-022-30765-y
2. Ali SA, Najmi WK, Hakami FM, Almubarak AA, Alhassan RA, Maafa SH, et al. Prevalence of Varicose Veins Among Nurses in Different Departments in Jazan Public Hospitals, Saudi Arabia: A Cross-Sectional Study. *Cureus*. 2022;14(4):e24462. doi: 10.7759/cureus.24462
3. Ganai FM, Rayees DA, Shafi AA. Study on prevalence and risk factors for varicose veins in a population. *Int J Health Clin Res*. 2022;5(1):17-18.
4. Glukhov AA, Aralova V. Klinicheskaya effektivnost' razlichnykh sposobov debridmenta troficheskikh yazv venoznoy etiologii [Clinical efficacy of various methods of debridement of trophic ulcers of venous etiology]. *Novosti khirurgii*. 2017;25(3):257–266. [Russian]. doi: 10.18484/2305-0047.2017.3.257
5. Carroll C, Hummel S, Leaviss J, Ren S, Stevens JW, Cantrell A, et al. Systematic review, network meta-analysis and exploratory cost-effectiveness model of randomized trials of minimally invasive techniques versus surgery for varicose veins. *Br J Surg*. 2014;101:1040-52. PMID: 24964976. doi: 10.1002/bjs.9566
6. Masuda E, Ozsvath K, Vossler J, Woo K, Kistner R, Lurie F, et al. The 2020 appropriate use criteria for chronic lower extremity venous disease of the American Venous Forum, the Society for Vascular Surgery, the American Vein and Lymphatic Society, and the Society of Interventional Radiology. *J Vasc Surg Venous Lymphat Disord*. 2020;8:505-25. PMID: 32139328. doi: 10.1016/j.jvsv.2020.02.001
7. Rabe E, Partsch H, Morrison N, Meissner MH, Mosti G, Lattimer CR, et al. Risks and contraindications of medical ESVS 2022 Clinical Practice Guidelines on the Management of CVD of the Lower Limbs 255 compression treatment - a critical reappraisal. An international consensus statement. *Phlebology.* 2020;35:447e60. PMID: 32122269. PMCID: PMC7383414. doi: 10.1177/0268355520909066
8. Varetto G, Gibello L, Frola E, Trevisan A, Trucco A, Contessa L, et al. Day surgery versus Outpatient setting for endovenous laser ablation treatment. A prospective cohort study. *Int J Surg*. 2018;51:180-3. PMID: 29412185. doi: 10.1016/j.ijsu.2018.01.039
9. Tettelbach WS, Cazzell FS, Caporusso JM. A multicentre prospective randomized controlled comparative parallel study of dehydrated human umbilical cord (epicord) allograft for the treatment of diabetic foot ulcers *Int Wound J.* 2019;16(1):122–130. PMID: 30246926. PMCID: PMC7380046. doi: 10.1111/iwj.13001

10. Zavaruyev AV, Bregadze AA, Kozka AA. Opyt khirurgicheskogo lecheniya venoznykh troficheskikh yazv [Experience in surgical treatment of venous trophic ulcers]. *Flebologiya.* 2016;10(2):103–105. [Russian]. doi: 10.17116/flebo2016102103-105
11. De Maeseneer MG, Kakkos SK, Aherne T, Baekgaard N, Black S, Blomgren L, et al. European Society for Vascular Surgery (ESVS) 2022 Clinical Practice Guidelines on the Management of Chronic Venous Disease of the Lower Limbs. *Eur J Vasc Endovasc Surg*. 2022:S1078-5884(21)00979-5. doi: 10.1016/j.ejvs.2022.06.022
12. Miguel AO, Oscar F-M, Cielo G-M, Miguel AÁ-M, Chen Ch, Fernando R-G, et al. Understanding Chronic Venous Disease: A Critical Overview of Its Pathophysiology and Medical Management. *J Clin Med*. 2021;10(15):3239. PMID: 34362022. PMCID: PMC8348673. doi: 10.3390/jcm10153239
13. Parihar S, Sars ati, Chattarpal, Sharma D. A Brief Review on Herbs Used in the Treatment of Varicose Veins. *J Drug Delivery Therapeutics*. 2022;12(1):158-162 doi: 10.22270/jddt.v12i1.5161

**УДК** 616.58:619.11-004.63.044

**ТРОФІЧНІ ВИРАЗКИ НИЖНІХ КІНЦІВОК: МОЖЛИВОСТІ КОНСЕРВАТИВНОГО ЛІКУВАННЯ**

***Аббасалієв Б. Б.***

**Резюме.** *Мета.* Оцінити ефективність низькоінтенсивного лазерного випромінювання у комплексному лікуванні трофічних виразок нижніх кінцівок у пацієнтів з варикозним розширенням вен на основі об'єктивних критеріїв.

*Матеріал та методи.* В дослідженні прийняли участь 75 пацієнтів віком 15-75 років, які пройшли лікування з приводу малих і середніх виразок II стадії нижніх кінцівок в Навчально-хірургічній Клініці Азербайджанського Медчного Університету та Центральній Лікарні Газахського района. Всім пацієнтам проведені клінічні та гістоморфологічні дослідження. В основній групі при лікуванні трофічних виразок нижніх кінцівок малих та середніх розмірів використовували мазь Venocoryl, низькоінтенсивне лазерне випромінювання та ендовенозна лазерна абляція із застосуванням модифікованого циліндричного світловоду з ptfe-покриттям (EVLA). До контрольної групи увійшли 25 пацієнтів, у регіональному лікуванні яких застосовувалися лише стандартні ретро специфічні методи лікування із застосуванням EVLA. До групи порівняння увійшли 25 пацієнтів, яким виконувалася EVLA та призначалась мазь «Venocoryl».

*Результати.* Швидкість загоєння трофічних виразкових ран протягом другого місяця після початку терапії в основній групі у пацієнтів основної групи становила 0,131±0,008 см$^2$ на добу, у групі порівняння 0,125±0,007 см$^2$; у контрольній групі склала 0,072±0,004 см$^2$ на добу. При спостереженні за хворими в термін до 6 місяців було зазначено наступне: в основній групі після застосування лазера вдалося повністю загоїти рановий дефект у 21 пацієнта (84%) основної групи, 17 пацієнтів групи порівняння (68%) та 13 пацієнтів контрольної групи (52%). У ході досліджень було виявлено, що в основній групі перший місяць йде активний процес епітелізації та скорочення виразкового дефекту, і, незважаючи на зниження у цій групі швидкості репаративних процесів, виразковий дефект епітелізується значно раніше та швидше.

*Висновки.* Висока швидкість загоєння при застосуванні лазерного випромінювання порівняно зі стандартним лікуванням зберігалася протягом усього періоду досліджень.

**Ключові слова:** варикозне розширення вен, трофічна виразка, лікування, швидкість епітелізації.

**ORCID and contributionship:**
Babak B. oglu Abbasaliyev : [A-F]

A – Work concept and design, B – Data collection and analysis,
C – Responsibility for statistical analysis, D – Writing the article,
E – Critical review, F – Final approval of the article

**CORRESPONDING AUTHOR**
**Babak B. oglu Abbasaliyev**
Azerbaijan Medical University,
Educational And Surgical Clinic,
General Surgery III Department
14, Gasimzade Str., Baku AZ 1022, Republic of Azerbaijan
tel: +994518928144, e-mail: statya2021@yandex.ru

*The authors of this study confirm that the research and publication of the results were not associated with any conflicts regarding commercial or financial relations, relations with organizations and/or individuals who may have been related to the study, and interrelations of coauthors of the article.*

Стаття надійшла 28.06.2022 р.
*Рекомендована до друку на засіданні редакційної колегії після рецензування*