

# Minimally invasive methods of surgical treatment of patients with varicose disease of the lower extremities

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## ABSTRACT

**Aim:** to improve the results of surgical treatment of patients with varicose veins of the lower extremities.

**Materials and Methods:** A retrospective evaluation of the treatment of 97 patients with a diagnosis of «varicose veins of the lower extremities».

Patients were divided into three groups: Group I (study), patients underwent EVLC, sclerotherapy foam-foam (STFF) and mini-phlebectomy - 61 cases; Group II, patients underwent EVLC and STFF - 43 cases and Group III, patients underwent EVLC and mini-phlebectomy - 45 cases.

The results of the performed intervention were evaluated clinically and with the help of duplex scanning (DS) the next day, after a week, 1 month, 6 and 12 months.

**Results:** In group I, the total frequency of postoperative complications reached 6.4% (4 cases). The overall frequency of complications in the group II reached 27.9% (13 cases). The overall frequency of complications in the group III reached 33.3% (15 cases).

**Conclusions:** 1) EVLC in combination with STFF and mini-phlebectomy gives the best results of surgical treatment of varicose veins.

2) In the studied group, where mini-phlebectomy and STFF were used, there is a mutual exclusion of postoperative complications.

**KEY WORDS:** varicose disease of the lower extremities, endovenous laser coagulation, radiofrequency ablation, trunk foam sclerotherapy, mechanochemical obliteration

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## INTRODUCTION

Varicose veins of the lower extremities is one of the most important medical and social problems associated with the high prevalence of the disease and dissatisfaction with the results of its treatment. The frequency of postoperative recurrences of the disease reaches up to 50%. In industrialized countries, the total cost of treating patients with varicose veins of the lower extremities is from 1.5 to 3% of the health care budget, which determines an important medical and social component of medical and surgical treatment of patients with varicose veins of the lower extremities [1-4].

Over the past decades, significant progress has been made in the treatment of varicose veins. In the treatment of patients, various surgical techniques are used, the list of which is growing over time. Open methods of treatment were replaced by such minimally invasive methods as endovenous laser coagulation (EVLC), radiofrequency obliteration, trunk foam sclerotherapy, cyanoacrylate obliteration, mechanochemical obliteration, cryostripping and others [4-8]. These techniques are used to eliminate trunk reflux in the great saphenous vein (GSV) and

small saphenous vein (SSV), their main tributaries, as well as in perforating veins. After elimination of trunk or perforating insufficiency, as a rule, it is necessary to perform an intervention on varicose tributaries. According to the literature, the choice of the method and scope of surgical treatment of varicose affected tributaries is quite variable [7-12].

Endovasal treatment methods make it possible to implement an individual approach to each patient and can be used both independently and in the combined treatment of varicose veins.

In modern conditions, in the presence of a wide range of operative methods for the elimination of pathological veno-venous refluxes and varicose and dilated subcutaneous veins, the doctor is faced with the question of choosing the optimal intervention option, which would combine minimal invasiveness and radicality.

## AIM

To improve the results of surgical treatment of patients with varicose veins of the lower extremities.

## MATERIALS AND METHODS

A retrospective evaluation of the treatment of 97 patients (149 lower extremities; 26 with bilateral lesions) with a diagnosis of «varicose veins of the lower extremities» who were treated in the surgical department of the National Medical Center «UMBKL» of the UMR was carried out.

Patients were examined using general clinical methods. To assess the degree and dynamics of edema, we used the anthropometric method of measuring the circumference of the limb at four standard levels (the middle of the foot, the level of the ankle joint, the level of the middle third of the leg, the level of the upper third of the leg).

The main instrumental method of examination was ultrasound angioscanning with Alpinion color Doppler mapping with a set of linear (5-10 MHz) and convex (2-5 MHz) sensors.

Patients were divided into three groups: Group I (study), patients underwent EVLC, sclerotherapy foam-foam (STFF) and mini-phlebectomy - 61 cases; Group II, patients underwent EVLC and STFF - 43 cases and Group III, patients underwent EVLC and mini-phlebectomy - 45 cases. In patients of all groups, varicose disease of the lower extremities was diagnosed for the first time.

All patients of the study group underwent EVLC of the main vein in combination with STFF and mini-phlebectomy of varicose tributaries in «key points». As a sclerosant, a foam form of a 0.5-2% solution of polidocanol, prepared according to the Tessari technique [13], was used. Mini-phlebectomy was applied according to the Varadi technique. The results of the performed intervention were evaluated clinically and with the help of duplex scanning (DS) the next day, after a week, 1 month, 6 and 12 months. Demographic and clinical data of patients who underwent endovasal laser coagulation of the main vein with one-moment microfoam sclerotherapy in combination with mini-phlebectomy are presented in Table 1.

All patients had reflux through the IVC and varicose tributaries. In order to eliminate trunk insufficiency, the EVLC technique was chosen. The procedure was performed under ultrasound control under local tumescent anesthesia. In the case of bilateral damage, operations were performed consecutively with an interval of 7 days. At the preoperative stage, all patients were marked with a permanent marker for varicose veins in a standing position. For the EVLC of the GSV trunk, the generally accepted technique was used (diode laser, wavelength 1470 nm and optical fibers with radial emission). After the treatment of the trunk vein was completed, STFF of varicose tributaries was first performed. The sclerosant was injected in small

volumes (1-2 ml) at several points, and not in a large volume for one injection. When the simultaneous ultrasound examination determined foam filling of all target veins, the injections were stopped. The total volume of the injected drug did not exceed 10 ml per operation. After completion of STFF, tumescent anesthesia and mini-phlebectomy according to Varada were performed in the marked veins. Skin punctures were performed with an 18G puncture needle along the marked tributaries. The «key points» were defined in advance: the first is the closest point to the point of confluence of the varicose inflow into the main vein, the second is the closest point to the point of reflux drainage into the deep venous system, the others are separated by about 10 cm from each other. Then, through skin punctures, the wall of the vein was grasped with a Varadi hook and its extraction was carried out. When the vein was brought out, it was picked up with clips of the «mosquito» type and with smooth pulling movements, it was removed by the cranial and distal ends at the maximum extent. The number of punctures varied in different patients and depended on the extent of the varicose syndrome. Most often it was 5-7. After this stage, the operated leg was treated with a solution of hydrogen peroxide and an antiseptic. Suturing of puncture holes was not required due to their small diameter. Sterile napkins were applied to the puncture sites and a class 2 compression stocking was put on. Patients were advised to walk calmly for 30-60 minutes immediately after the operation. Ultrasound control were performed the next day, after 1, 6 and 12 months. after intervention or as needed in case of complaints.

## RESULTS

EVLC GSV was successfully performed in all cases. In the observation period up to 12 months. There was no case of IVC recanalization, corresponding to 100% obliteration of the target segment. The success of sclerotherapy and mini-phlebectomy was evaluated by the frequency of postoperative complications in the form of infectious complications and matting, postoperative hyperpigmentation, formation of coagulum and ecchymoses, skin necrosis, recanalization of segments, and inflammation in the postoperative period (Table 2).

In group I, the total frequency of postoperative complications reached 6.4% (4 cases). All patients with CVI C5 with residual hyperpigmentation after 12 months.

The overall frequency of complications in the group where patients with EVLC combined with STFF reached 27.9% (13 cases). In addition, most often

**Table 1.** Demographic and clinical data of patients

Characteristic	Value
Number of patients	97
Number of lower limbs/ on both sides	149 / 26
Gender, men and women	27 / 70
Average age	51,4 (±14,1)
Clinical picture by CEAP classification	
C2	47 (32%)
C3	76 (51%)
C4a	20 (13%)
C5	6 (4%)

**Table 2.** Postoperative complications in patients of different groups

Complication	Number (%)		
	I	II	III
Hyperpigmentation	4	7	4 (6,4%)
Formation of coagulum	0	6	0
Matting and ecchymoses	0	2	10
Thrombophlebitis of residual veins	0	0	6
Skin necrosis	0	2	0
Suppuration of p/o wounds	0	2	2
Recanalization	0	2	7
Total patients:	4(6,4%)	13(27,9%)	15(33,3%)

patients experienced hyperpigmentation (7 cases), formation of clots that required surgical intervention (6 cases), recanalization (2 cases); skin necrosis due to perivascular injection (2 cases). A combination of several complications (hyperpigmentation and clot formation) was observed in 2 patients.

The overall frequency of complications in the group where patients with EVLC combined with mini-phlebectomy reached 33.3% (15 cases). In addition, the patients most often had ecchymoses and bruises (10 cases); varicothrombophlebitis of residual veins (6 cases), paresthesias of various areas of the lower extremities (7 cases); suppuration of p/o wounds (2 cases); A combination of two complications was observed in 2 patients (bruises, varicothrombophlebitis of residual veins, paresthesias). Other 2 have a combination of 3 or more complications.

Deep vein thrombosis was not detected in any group.

To eliminate the tympanic reflux in all studied groups, we chose EVLC, because it is not inferior to traditional surgical intervention in terms of effectiveness and is characterized by minimal trauma, quick recovery of working capacity, good cosmetic result and minimal negative impact on the quality of life [14]. Our occlusion indicators during 1 year of observation (100%) confirm the data of world literature and other studies [2, 3,

5]. Currently, there are two main ways to eliminate varicose veins of the STFF and mini-phlebectomy. Each of these treatment options has its advantages and disadvantages.

The best treatment results were presented in group I, for which we used EVLC in combination with STFF and mini-phlebectomy. The frequency of complications in this group reached 6.4%.

The highest frequency of complications (33.3%) was noted in the group where mini-phlebectomy was used in parallel with EVLC. The most frequent complications were bruises and ecchymoses, thrombophlebitis of residual veins and paresthesias, which is explained by the peculiarity of the mini-phlebectomy technique.

When using a combination of both methods, we observe the mutual exclusion of the disadvantages of each individual procedure.

## DISCUSSION

The ultimate goal of any method of treating varicose veins of the lower extremities is to restore the somatic level of health and ensure a high quality of life for patients after surgery. The main goal of surgical treatment of varicose veins of the lower extremities today is the elimination of the pathogenetic mechanism

of the disease, namely, pathological veno-venous refluxes, which is achieved by crossing and ligation of insufficient perforating veins, sapheno-femoral and sapheno-popliteal joints and removing varicose dilated subcutaneous veins.

The traumatic nature of saphenectomy and related complications led to the search for ways to change treatment tactics - from mechanical removal to intravascular manipulations accompanied by delayed fibrous transformation caused by chemical or high-energy damage to the venous wall.

Endovasal laser coagulation (EVLC) is a method of «caking» veins, which is based on the mechanism of selective photocoagulation - selective absorption of laser energy of a certain wavelength by various components of biological tissues, which leads to their destruction. The main advantage of EVLC, in addition to minimal invasiveness and cosmeticity, is a low risk of complications, the use of local anesthesia, a reduction in the duration of treatment and incapacity for work.

Currently, better tolerability of EVLC with the use of W-laser and reduction of the rehabilitation period compared to traditional operative treatment have been proven, in the absence of significant differences in the frequency of disease recurrence. Due to the transition from the use of hemoglobin-absorbing H-lasers (0.81-1.06  $\mu\text{m}$ ), which cause excessive carbonization and tissue necrosis due to low water absorption, to W-lasers (1.47-1.56  $\mu\text{m}$ ), for which at short-term exposure is characterized by the predominance of denaturation over carbonization, the efficiency and safety of laser obliteration has increased significantly. There are no such complications as skin burns and thrombophlebitis, and less pronounced pain syndrome when EVLC is performed on laser devices with a long-wave spectrum. EVLC is devoid of the risk of side effects associated with regional anesthesia and the risk of complications typical for endoscopic dissection of perforating veins. In addition, after conducting EVLC, patients usually do not need bed rest and long-term anesthesia, since they have practically no pain syndrome [1, 11, 12, 14, 15].

Sclerotherapy is a method of treating varicose veins by introducing a chemically active agent into the lumen. Traditionally, it was performed with the help of the introduction of a liquid form of sclerosant. With the development of phlebology and the widespread introduction of ultrasound diagnostic methods for vein diseases, microfoam sclerotherapy (STFF) was introduced and proved itself as a more effective technique. Its advantages are the visual controllability of the spread of the sclerosant, short duration, low cost, the possibility of eliminating pelvic-gonadal and perforating venous insufficiency, recurrent variant of

varicose syndrome or progression of varicose disease. Disadvantages can be recanalization of sclerosed tributaries at low concentrations, thrombophlebitis, hyperpigmentation, matting, skin necrosis, deep vein thrombosis, allergic reactions, pulmonary embolism [13].

Mini-phlebectomy (MFE) is a method of treating varicose veins, which is most often performed under local anesthesia in an outpatient setting using special tools (18G needles, hooks for mini-phlebectomy, «mosquito» type clamps). Varicose veins are removed through point punctures and/or microincisions of the skin. Mini-accesses give a good cosmetic result compared to traditional surgical interventions, but this surgical method also has its drawbacks. In the case of incomplete removal of varicose veins, their segments may remain in the subcutaneous tissue, in which local inflammation often develops, causing significant discomfort in the immediate postoperative period. In some cases, incomplete removal may require repeated interventions. It should also be remembered that most often the marking of varicose tributaries is carried out in a vertical position and when the patient changes the position to a horizontal one, the anatomical course of the «target veins» may change. This nuance makes it difficult to find veins and, as a result, leads to a large number of accesses and traumatization of tissues, as well as to the occurrence of a greater number of hematomas and ecchymoses in the postoperative period. Other complications can be infections and matting, extremely rarely - postoperative bleeding and deep vein thrombosis. Such a complication as postoperative neuralgia is the result of unintentional damage to skin nerves with the tip of a needle or a hook, which leads to the emergence of a pronounced pain syndrome with temporary sensory disturbances.

Removal of subcutaneous veins by cryostripping is a relatively new method of treating varicose veins, which is now being used more and more often. Removal of a vein with the help of a cryoprobe allows to shorten the operation time, shorten the patient's stay in the hospital, reduce the severity of the pain syndrome, and improve the cosmetic results. The cold effect during cryoextraction leads to a decrease in the volume of hematomas, a decrease in the intensity of the inflammatory process and an increase in the patient's comfort level, which in turn reduces the rehabilitation period. The use of cryoprobes allows you to minimize the number of accesses and achieve a better cosmetic effect. The possibility of paravasal use of a cryoprobe without an anechoic lumen or pronounced tortuosity of the venous trunk of the saphenous vein, in addition to reducing the number of accesses, also leads to a

reduction in the duration of surgical intervention. The analysis of immediate results allows us to state that cryostripping is the most promising method aimed at removing the trunks of the subcutaneous veins of the lower extremities. It combines efficiency and safety, which allows its wide application in the surgical treatment of varicose veins of the lower extremities [16].

An alternative to EVLC was the method of radiofrequency ablation of main subcutaneous veins. The RFA technique entered clinical practice in 1998. Intravascular thermolysis is carried out using the Closure Vein Treatment System (VNUS), due to which a dosed thermal effect causes irreversible damage to the proteins of the vascular wall, while not violating the integrity of the wall itself [11, 14].

Mini-invasive surgical interventions can be performed on an outpatient basis, which has a positive effect on the psychological state of patients, reduces the risk of infectious and thromboembolic complications, and expands the range of patients who are shown

modern specialized care for varicose veins of the lower extremities.

In connection with the introduction of new surgical technologies in the treatment of varicose veins of the lower extremities, there was a need for a more thorough study of endovascular methods, the results of their use, improvement of the technical aspects of the operation, which contribute to increasing the effectiveness of these treatment methods.

## CONCLUSIONS

1) EVLC in combination with STFF and mini-phlebectomy gives the best results of surgical treatment of varicose veins. The frequency of complications reached 6.4%, more than 5 times less than in the group where isolated mini-phlebectomy was used, and more than 4 times less than when using isolated STFF.

2) In the studied group, where mini-phlebectomy and STFF were used, there is a mutual exclusion of postoperative complications.

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### CONFLICT OF INTEREST

The Authors declare no conflict of interest

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