

Microcirculation Specialist Consensus on Diagnosis and Treatment of Superficial Varicose Veins of Lower Limbs

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Abstract

Superficial varicosity of lower limbs is a common clinical manifestation, with the most common being varicosity of the great saphenous vein, caused by various reasons. It is either a clinical manifestation or a disease that affects the quality of life of patients to a certain extent. The causes of superficial varicosity of lower limbs consist of congenital venous valve dysfunction, primary venous valve insufficiency of lower extremities or secondary deep venous thrombosis of lower extremities, iliac vein entrapment syndrome, etc. The superficial varicosity of lower limbs caused by secondary causes needs to focus on the treatment of primary diseases, and its diagnosis and treatment process is special, so it is not discussed in this paper. The normative evaluation and treatment of superficial varicosity of lower limbs will be beneficial to cut short the course of the disease and improve the prognosis. At present, there are different theories about the pathogenesis of superficial varicosity of lower limbs. The relatively consistent agreements on the theory include venous pressure elevation, valvular regurgitation, and superficial venous lumen dilatation caused by venous valve dysfunction of axial veins, resulting in venous tortuous and swelling, exudation into the surrounding subcutaneous tissue, and then triggering a series of clinical manifestations.

Keywords: Varicose Veins; Microcirculation; Expert consensus

1. EVALUATION OF SUPERFICIAL VARICOSIS OF LOWER LIMBS

At present, the authoritative international methods and criteria for evaluating the severity of chronic venous disease and its therapeutic effect mainly include CEAP classification and venous clinical severity score (VCSS). With the common applications of artificial intelligence and image recognition processing technology in clinical practice and continuous updating of the disease concept, a new classification method has been recognized in the medical industry,^[1] which is used for more rational differentiation of clinical stages and beneficial to its standardized treatment. Rutherford presented VCSS, including pain, edema, venous claudication, pigmentation, lipid scleroderma, ulceration, ulcer diameter, disease stage, recurrence, and number of 10

assessment items, with every single item of 0-3 points and the total score of 0-30 points. A low score indicates that the condition is mild. The higher the score is, the worse the condition will be. The scoring system is better suitable for more severe varicosity of lower limbs, and it has been revised many times (Table 1^[2]).

2. DIAGNOSIS OF VARICOSIS OF LOWER LIMBS

2.1 Medical record collection

Ask patients about the history of varicosity of lower limbs, especially if there is a history of secondary varicosity of lower limbs. The symptoms in the early stage are relatively mild; mainly including limb soreness, distention, discomforts, and pain of the affected limb. The

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Table 1 Clinical Severity Score for Modified Veins ^[2]

Assessment items	0 point (no)	1 point (mild)	2 point (moderate)	3 point (severe)
Discomforts caused by pain or other venous factors (e.g. pain, heaviness, fatigue, soreness, and burning sensation)	None	Occasional (unlimited activities)	Daily (limited activity)	Daily (obvious limited activity)
Varicosity (varicose vein's diameter ≥ 3 mm when standing)	None	There are a few scattered single vein/venous plexus or confined to the ankle.	Multiple, confined to the calve or thigh	Multiple, widely involved in the calf and thigh
Venous edema	None	Confined to the ankle	Involved above the ankle and below the knee	Involved in the knee and above the knee
Pigmentation (excluding varicose veins and excluding other non-venous factors)	No/only partial varicose veins	Confined to the ankle circumference	Diffused above the ankle and below 1/3 calf	Extensive involvement over below 1/3 calf
Inflammation (e.g. erythema, cellulitis, venous eczema, and dermatitis)	None	Confined to the ankle circumference	Diffused above the ankle and below 1/3 calf	Extensive involvement over below 1/3 calf
Sclerosis (chronic edema with fibrosis, subcutaneous tissue inflammation), including atrophieblanche and lipodermatosclerosis	None	Confined to the ankle circumference	Diffused above the ankle and below 1/3 calf	Extensive involvement over below 1/3 calf
Number of active ulcers	0	1	2	≥ 3
Active ulcer duration (maximum)	None	<3 months	3 months - 1 year	The protracted course of disease exceeds one year.
Active ulcer diameter (maximum)	None	<2 cm	2~ 6 cm	>6 cm
Pressure therapy.	No use	Intermittent use	Use of most of the time	Good compliance, continuous use

later symptoms are mainly caused by various complications, such as skin changes in the ankle boot, ulceration, pain along the veins caused by superficial thrombotic vasculitis, bleeding of varicose veins, etc.

2.2 Physical examination

The main signs of superficial varicosity of lower limbs include vermiform protuberance, dilatation, and detour in the superficial veins of lower limbs, as well as complication-related skin changes and ulceration in the ankle boot. A careful examination of relevant signs can facilitate an accurate assessment of the condition.

Traditional physical examination methods include the great saphenous valve function test (Trendelenburg test), the deep vein patency test (Perthes test), and perforating vein valve function test (Pratt test). This kind of examination method is relatively rough. They can only be used for preliminary evaluation of the venous function of lower limbs, not for diagnostic purposes. It has been rarely used clinically.

2.3 Auxiliary examination

2.3.1 Imaging examination

(1) Color Doppler vascular ultrasound: Vascular ultrasound

examination can simultaneously identify the deep and superficial vein function of lower limbs and the existence of regurgitation or thrombosis. The examination is safe, non-invasive, simple, and quick, with high accuracy. Breath-holding test (Valsalva), squeeze test, etc. can be performed during the operation in order to further clarify the presence of regurgitation in the great saphenous vein. The examination findings are accurate and reliable providing direct guidance and assistance for operation. It is the first auxiliary examination method for the diagnosis of varicosis of lower limbs currently.

(2) Digital subtraction angiography antero/retrograde venography: With the development of interventional technology, digital subtraction angiography (DSA) is becoming more and more widely used. Antero/retrograde venography is regarded as the gold standard for the diagnosis of varicosis of lower limbs. Since DSA is an invasive examination, the routine diagnosis is still dominated by vascular color ultrasound that is clinically acceptable. However, in some cases, such as congenital venous malformation of lower limbs, complex communicating vein and deep vein dysfunction, iliac vein entrapment syndrome, or stenosis, the DSA has advantages such as intuition and accuracy, and cannot be replaced.

(3) Computed tomography venography (CTV)/magnetic resonance venography (MRV): CTV/MRV can be used in the diagnosis of venous obstructive disease and congenital venous disease. The scope of application is similar to venography, but the accuracy is not as good as venography. It is particularly preferred to diagnose tumor lesions or exogenous compression.

2.3.2 Laboratory examination

When diagnosing varicosis of lower limbs, there are few laboratory tests to rely on. It mainly assists the diagnosis of related complications. For example, blood routine, C-reactive protein (CRP) and D-dimer tests, and other assays for markers of inflammation and thrombosis could be added for diagnosis in patients with superficial thrombophlebitis.

3. NON-OPERATIVE TREATMENT OF SUPERFICIAL VARICOSIS OF LOWER LIMBS

In recent years, the importance of drug therapy has gained increasing attention and a comprehensive treatment including drug therapy with pressure therapy and/or operation has become a new trend. The comprehensive treatment regimen has a significant effect on restraining and relieving the pathophysiological changes of superficial

varicosis of lower limbs. Meanwhile, it also plays an important role in consolidating the curative effect of the operation.

3.1 Medicine treatment

The treatment drugs for superficial varicosis of lower limbs mainly consist of intravenous active drugs, including flavonoids, aescigenin, coumarins, etc., which can be used to relieve the patients' clinical manifestations of lower extremity heaviness, uncomfortable soreness and distension, pain, and edema. The main mechanisms of action consist of: (1) reducing the capillary permeability, anti-inflammation, and anti-exudation; (2) protecting veins and improving vein elasticity and tension; (3) promoting venous return and lymphatic return and improving micro-circulation; and (4) anti-oxygen free radical and protecting damaged tissue cells. Other drugs include other types of vasoactive drugs, such as calcium dobesilate and pentoxifylline, etc.; anticoagulant and antiplatelet drugs, such as fondaparinux sodium injection (Arixtra), etc.; prostaglandins such as prostaglandin E1; traditional Chinese medicine for promoting blood circulation and removing blood stasis; non-steroidal anti-inflammatory drugs, glyocalyx and endangium-protective drugs such as sulodexide (vessel Due), etc.

Drug treatment can effectively alleviate the clinical symptoms and signs of patients. Preoperative use can mitigate the need for operation and delay the disease progression. Postoperative use can prevent early complications and consolidate surgical efficacy. It can be used in all stages of varicosity.^[3,4]

3.2 Pressure therapy

Pressure therapy of superficial varicosis of lower limbs includes elastic bandage, graduated elastic compression and intermittent pneumatic compression, etc., which will gradually reduce the pressure from the distal to proximal lower extremities, allowing the superficial vein to completely wilt, and promote the venous reflux through the deep veins. Pressure therapy can not only be used for the treatment of varicose veins and their complications but also serves as an auxiliary measure after surgical treatment, especially after a minimally invasive operation. It is suitable for all stages of varicosity.^[5,6]

Pressure therapy should meet the following requirements: 1) to relieve the condition and degree of pathological blood stasis and contain the pathological high venous pressure while resting and moving, 2) to promote the excessive water reabsorption in edema tissues, 3) to relieve the burden of the venous and lymphatic system, and 4) to reduce the inflammatory response caused by long-term edema.

3.3 Treatment with injecting hardeners

3.3.1 Types of hardeners

The sclerosing agents for the treatment of superficial varicosis of lower limbs can be divided into two categories based on their chemical structure; (1) Surface activators or decontamination agents, namely foam hardeners: This kind of material directly destroys venous endothelial cells and offers the benefits of a lower dosage, a larger intimal contact surface, and a longer contact time. Therefore, it is widely used at present. (2) Chemical irritants or hypertonic solution: Both of them are liquid sclerosing agents, which act directly on the endothelial cells to make them necrotic. Because of many adverse reactions, they are rarely used in clinics at present.^[7,8]

3.3.2 Indications

The sclerosing agent injection therapy for superficial varicosis of lower limbs is to use the sclerosing agents to inject into the venous cavity, stimulate the intima of the vein to make it adhere resulting in fibrosis and thus eliminate or alleviate local venous high pressure. It is recommended for all applications to all types of patients with varicosis of lower limbs. It can be used alone for mild varicosis. Generally used as the adjuvant treatment of operation, the treatment of postoperative residual varicose veins is particularly appropriate, especially for capillary and reticular vein dilatation, small varicose veins, and varicose veins with a large diameter of non-saphenous vein trunk. It can also be applied to patients who cannot tolerate the operation.

3.3.3 Contraindications

Absolute contraindications include allergy to hardeners; history of collagen diseases; recent history of thrombosis and pulmonary embolism with local or systemic infection; bed-ridden patients; and patients with severe ischemia of lower extremities.

Relative contraindications include Allergic constitution, early pregnancy and lactation, Latex allergy, hypercoagulability (S protein deficiency, etc.), history of recurrence of deep vein thrombosis or pulmonary embolism, diabetic microcirculatory lesions, and uncontrolled hypertension (such as pheochromocytoma).

3.3.4 Precautions

Each injection site with the hardener needs to be locally filled, and the dose depends on the diameter of the vein. It should be injected slowly to avoid excessive resistance. After each injection site is finished, the assistant shall use the dry sterilized cotton balls to press the needle hole tightly while pulling the needle out quickly. The total amount of injection foam is generally not more than 10 ml. The dosage

can be increased appropriately after evaluating the risk and benefit. After completing the treatment at all injection sites, the patient's affected limb shall be immediately given a pressure bandage.

4. OPERATIVE TREATMENT OF SUPERFICIAL VARICOSIS OF LOWER LIMBS

Currently, surgical treatment is an effective method for the treatment of varicosis of lower limbs on stage C2 or above. Before the operation, the patient should be comprehensively evaluated to determine the severity, location, and characteristics of the lesion, and thus to determine whether there are surgical indications and appropriate surgical methods to be selected. The surgical treatments of superficial varicosis of lower limbs are mainly as follows.

4.1 Traditional stripping theory of great saphenous vein

This is a traditional operation, which fundamentally eliminates the reflux caused by the insufficiency of the great saphenous valve and it is also a relatively radical operation approach. Disadvantages include multiple incisions and great trauma. This procedure has many approaches including anterograde stripping, retrograde stripping, anterograde + retrograde stripping, and hemodynamics-based outpatient operation.^[8-10]

The traditional and modified procedures can be performed with minimal incisions minimizing the trauma. Endovenous minimally-invasive operation (or a new stripping catheter) also tends to be accompanied by small point incisions to treat these cystic dilations at the root of the great saphenous vein and large distorted clusters under the knee. Based on the economic development, the modified point incision procedure technique of traditional high ligation of great saphenous vein + stripping is worth popularizing.

4.2 Endovenous laser ablation

Endovenous laser ablation (EVLA) is a new minimally invasive technique for the treatment of varicosis of lower limbs that have emerged at the beginning of this century. Principle: A light-conducting fiber is imbedded in the vein. The laser will be converted into heat energy through the light-conducting fiber, acting on the venous intima and causing thermal damage. The collagen of the venous intima is shrunken resulting in fibrosis and blocking the varicose vein. During the laser ablation operation (including radiofrequency and other thermal effect therapy), it is often necessary to inject the tumescent anesthetic between the deep and superficial fascia adjacent to the vein. The concept of anesthetic fluid was first proposed in China in 2005. A

good tumescent anesthetic can achieve the purpose of local analgesia, compression of vein cavity, and avoid skin burn simultaneously. The suitable proportion of tumescent anesthetic solution should meet certain requirements.^[11] Effect of EVLA is equivalent to high ligation of great saphenous vein + stripping. This method is not only easy, minimally invasive, aesthetic, and economical, but also has other advantages such as short hospital stay, quick rehabilitation, and available outpatient operation. The disadvantages are that the penetration of laser may cause vein breaking, ecchymosis, saphenous nerve damage, numbness, tingling, etc. At present, a new loop fiber optic gyroscope, double-loop, even multi-loop fiber optic gyroscope can help to reduce the power and thus reduce the damage.^[12] EVLA is welcomed and widely used clinically because of its safety, efficiency, low recurrence rate, and economic benefits.

4.3 Radiofrequency ablation

Radiofrequency ablation (rFA) generates heat through radiofrequency generators and dedicated electrode catheters, causing hyperthermia of local tissue in contact with the emitter electrode within a limited range, resulting in vascular endothelial damage, contraction of collagen fibers in the venous intima until the vein is closed and finally fibrosed. rFA is used to treat the varicose veins in the lower extremities which can be performed by small incision or puncture. However, it needs color ultrasound guidance and localization. rFA, which is also a new technology that emerged at the beginning of this century, has the advantages of minimal invasion, a short length of hospital stay, and quick rehabilitation. Its tissue penetration is weak, and the damage to surrounding tissues is relatively small.^[13] rFA can only handle the proximal main trunk. The distal main trunk and its branches need to be treated separately. In recent years, with the continuous improvement of living standards, technology has been favored by some specialists. Nevertheless, clinical use is limited because of the expensive supporting facilities.

4.4 Transilluminated powered phlebectomy

Transilluminated powered phlebectomy (TIPP) adopts the superficial varicose vein removal system by making the cold light source enter into the subcutaneous superficial fascia layer; expanding the space through the infusion of tumescent fluid; utilizing the skin transmittance to make the tortuous superficial veins direct display; and using the rotary knife to accurately slice the targeted varicose vein and sucking it out. Experienced surgeons can even use no light source to achieve the goal of treatment.^[14] This method is suitable for the large area of varicose vein clusters. In view of the lymphatic and sensory nerve trauma caused by phlebectomy,

there is a certain requirement for the surgeon. This kind of operation only manages the varicose branches and the trunk needs to be dealt with separately. Moreover, because of the problem of consumables charge, the clinical popularization and application are limited.

4.5 Endovenous microwave therapy

Endovenous microwave therapy is a new method for the treatment of superficial varicosis of lower limbs. The principle is to make the venous intimal fibrosis contract through thermal energy thereby facilitating the atresia of the lumen. Due to the limitation of charging the microwave catheter, it fails to be widely popularized.

4.6 Endovenous electrocoagulation therapy

Catheter electrocoagulation promotes intima adhesion, makes lumen close, and blocks varicose vein blood flowing back through electrically burning venous intima, which can achieve the same effect as removing blood vessels. However, because the power control of electrocoagulation is difficult to overcome, the use of disinfection electrocoagulation catheters in veins is limited by relevant regulations. Therefore, there are few users at present.

4.7 Endoscope-assisted perforating venous dissection

Endoscope-assisted leg perforating venous dissection emerged at the end of the last century. The perforating vein is ligated using a special instrument under the endoscope in order to block the reflux of the pathological perforating vein. The need for surgical incisions and special equipment increases the complexity of the operation. Moreover, it does not reduce surgical trauma. In addition, there are other more simple and effective procedures and this method is rarely used at present.

4.8 Mechanized stripping

Two types of mechanized ablations have emerged recently. (1) Mechanical injection of foam hardener: The intima of the main trunk of the great saphenous vein is roughened and rendered spasmodic by mechanical devices. In addition, only a small amount of foam hardener can be injected to close the trunk and its branches. (2) A mechanical device directly injects cyanoacrylate (medical super glue) into the main trunk of the great saphenous vein. This kind of treatment completely changes the damaging effects of thermal ablation in principle and makes the postoperative local reaction decrease significantly, which is one of the developing directions of minimally invasive treatment of varicose veins in the lower extremities in the future. At present, these two types of mechanical devices have their corresponding products in Western countries, the promotion of which is rapid and the related work is also being carried

out here in China.

For the non-surgical and surgical treatment of superficial varicosis of lower limbs, all hospitals should choose them according to the patient's condition and the operator's expertise. Non-surgical treatment is an effective supplement to surgical treatment, which can run through the whole course of treatment procedure. High ligation of great saphenous vein + stripping is still an important surgical method for treating superficial varicosis of lower limbs in China. In recent years, the concept of minimally invasive treatment has been widely recognized in the industry. Besides, the effect of minimally invasive treatment is equivalent to the high ligation of great saphenous vein + stripping treatment. There are many minimally-invasive methods for the treatment of superficial varicosis of lower limbs, and they should be applied in accordance with each patient. According to the patient's request and their economic condition, it would be better to choose "123 Treatment Regimen": That is, an individualized reasonable choice of one or two or three methods among three regimens including endovenous thermal ablation, point stripping, and foam sclerosing agents, striving to achieve more minimally invasive, more beautiful aesthetic and more radical treatment.

The treatment of superficial varicosis of lower limbs is a procedure of comprehensive treatment, but also a complex process. This consensus still has shortcomings that need to be validated in time as well as practice, and need further in-depth studies to provide more sufficient evidence. Therefore, this consensus will serve as a reference tool for the majority of medical staff. We hope to bring help and convenience for the work of everyone and we hope to promote the standardization of the diagnosis of superficial varicosis of lower limbs in China.

CONFLICT OF INTEREST:

None

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