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MEDICAL FACULTY
DEPARTMENT OF SURGICAL DISEASES

THE LOWER EXTREMITIES VARICOSE VEINS

(study guide for self-training of 5-6 year students of higher medical educational institutions)

Uzhhorod – 2023

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CONTENT

1. INTRODUCTION.

The study guide is devoted to an important section of vascular surgery - the lower extremities varicose veins.

Varicose veins of the lower extremities is one of the oldest diseases known to mankind. Despite the centuries-old history, the relevance of the problem of varicose veins has not lost its importance and remains one of the most important in modern angiology.

According to the results of epidemiological studies, in European countries, vein pathology occurs in 25-50% of the population, 10-15% have pronounced varicose veins and 5-15% have trophic disorders.

The main method of treatment of varicose veins remains surgical intervention. The tactic of surgical treatment is determined by the form of varicose disease and the stage of chronic venous insufficiency. Today, preference is given to the use of mini-invasive technologies.

The study guide is intended for students of V - VI courses of higher medical educational institutions.

2. ANATOMICAL AND PHYSIOLOGICAL FEATURES OF THE LOWER EXTREMITIES VENOUS SYSTEM.

The anatomical structure of the venous system has considerable variability (pic.1, 2). The superficial venous system of the lower extremities include the large and small saphena (subcutaneous) vein, and their tributaries. Veins of the large saphena vein system have multiple connections with the system of a small saphena vein.

The large saphena vein in the inguinal area drains into the common femoral vein. Into the large saphena vein mouth drain five branches: v. pudenda externa superficialis; v. epigastrica superficialis; v. circumflexa ilei superficialis; v. accessoria lateralis; v. accessoria medialis. One of the largest branches of the large saphena vein on the shin is the Leonardo vein, which due to the numerous of perforating veins, placed on the medial surface of the shin, connects to the deep venous system.

Usually small saphena vein is represented by one well-defined trunk, which runs on the back surface of the shin. Most often, the small saphena vein on the level of popliteal fossa drains into the middle division of the popliteal vein. Occasionally, small saphena vein can goes on the hip independently and continues into the femoral-popliteal vein (Giacomini vein). Giacomini vein connects the small saphena vein with the femoral segment of the large saphena vein.

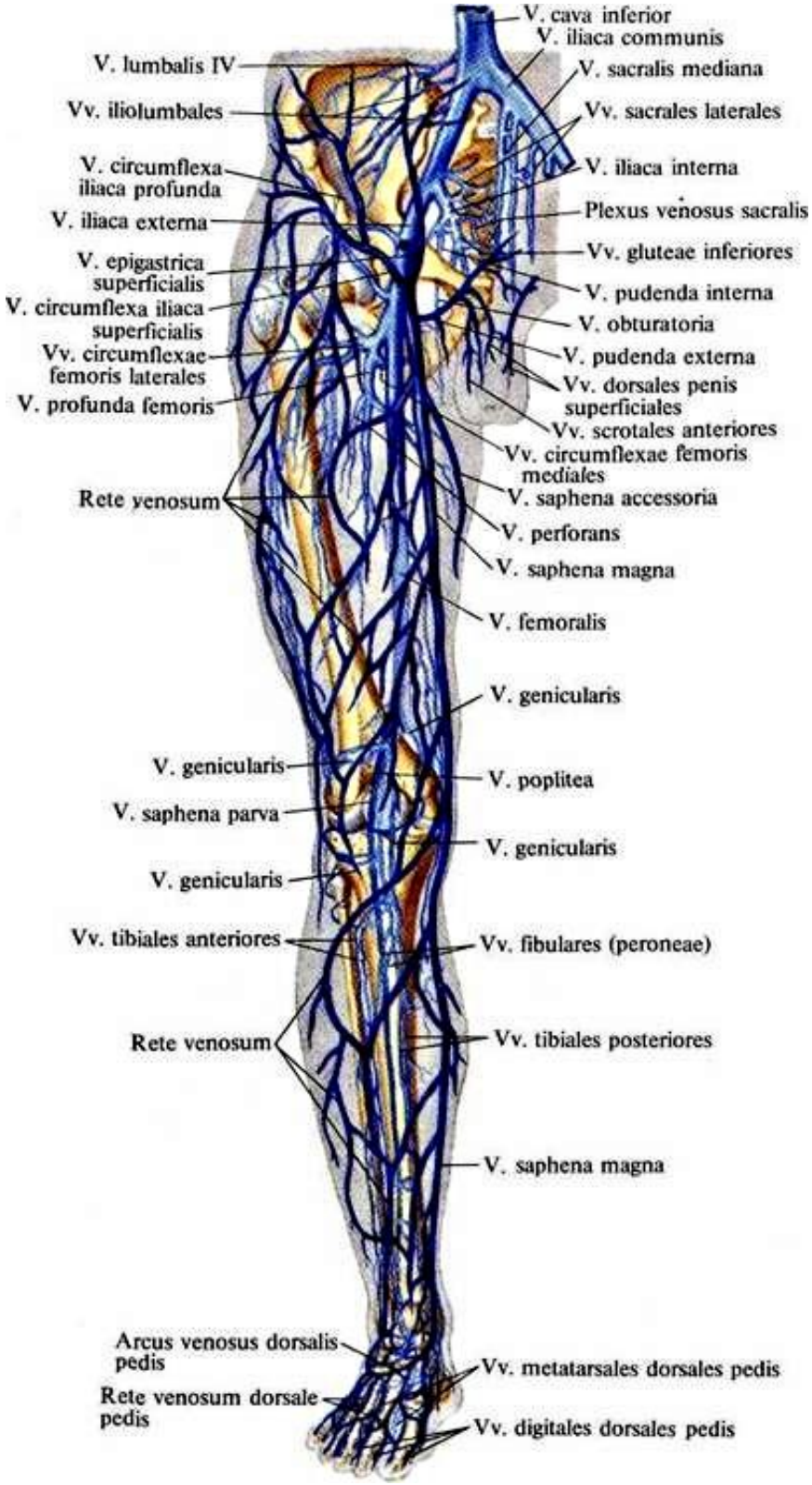
The deep veins of the lower extremity usually are paired on the level of the shin. The posterior tibial, fibular, and anterior tibial veins accompany the arteries with the same name, they flows together and form the popliteal vein. The set of deep veins of the shin is the main drainage system of the lower limb. Through these vessels goes a venous outflow from intramural muscular veins, veins of bones and joints. At the same time, this system provides basic blood drainage from the superficial vein system through the perforating veins.

The popliteal vein is represented by a short trunk, which is formed by the flows of the deep veins of the shin 3 - 8 mm below the head of the tibia. The popliteal vein crosses the articular cleft and continues in the superficial femoral vein at the level of the adductorial canal.

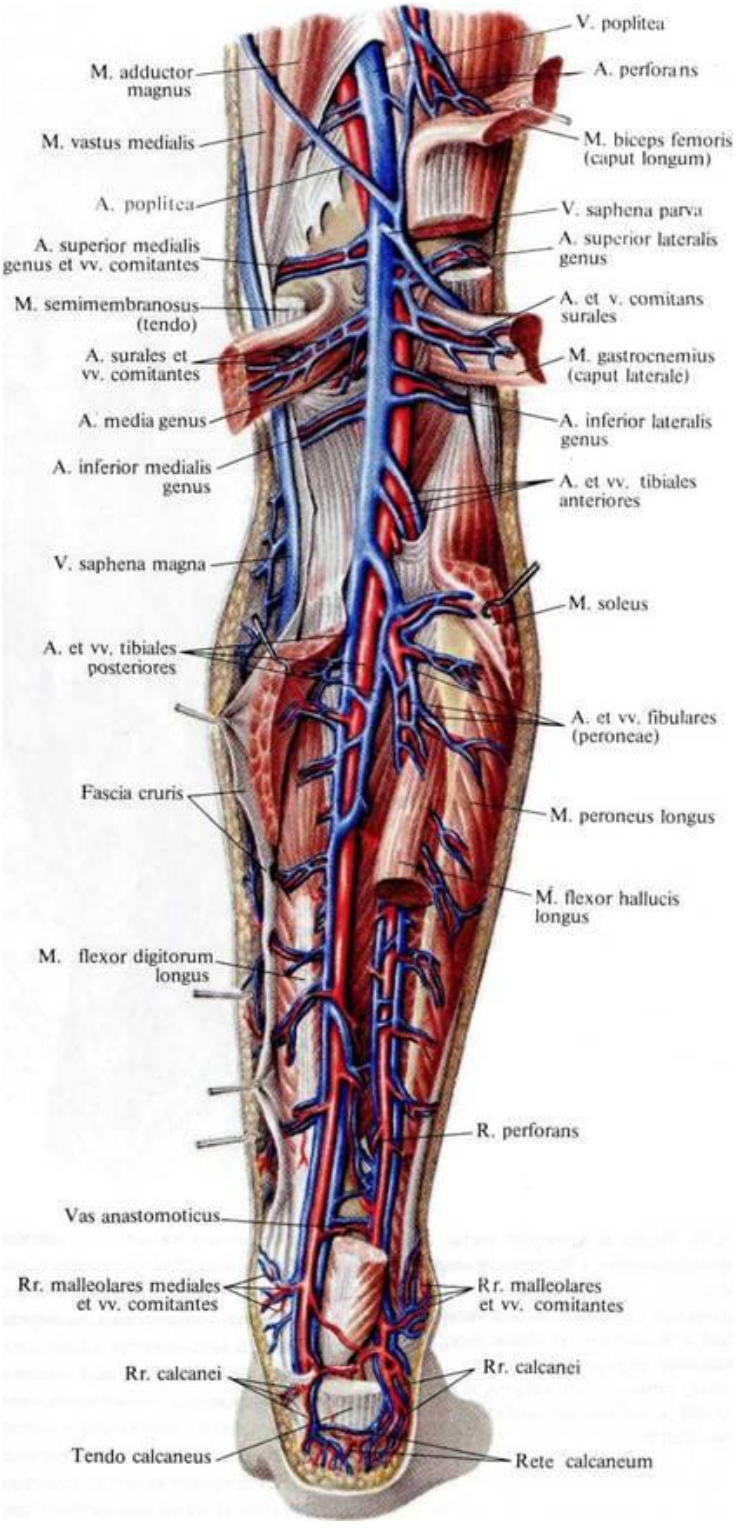
The superficial femoral vein passes into the common femoral vein at the level of the confluence with the deep femoral vein. The deep femoral vein is the largest tributary of the common femoral vein, which is formed as a result of the confluence of the muscular veins. Most often, it flows into the common femoral vein in the upper third of the thigh, usually 6 - 7 cm below the inguinal ligament.

At the level of the inguinal ligament the common femoral vein goes into the external iliac vein. External iliac vein proceeds to the level of the sacroiliac joint, where it connects with the internal iliac vein and they form the common iliac vein.

The right and left common iliac veins after their connection form the inferior vena cava, which collects blood via its tributaries from the lower half of the human body and carries it to the right atrium.



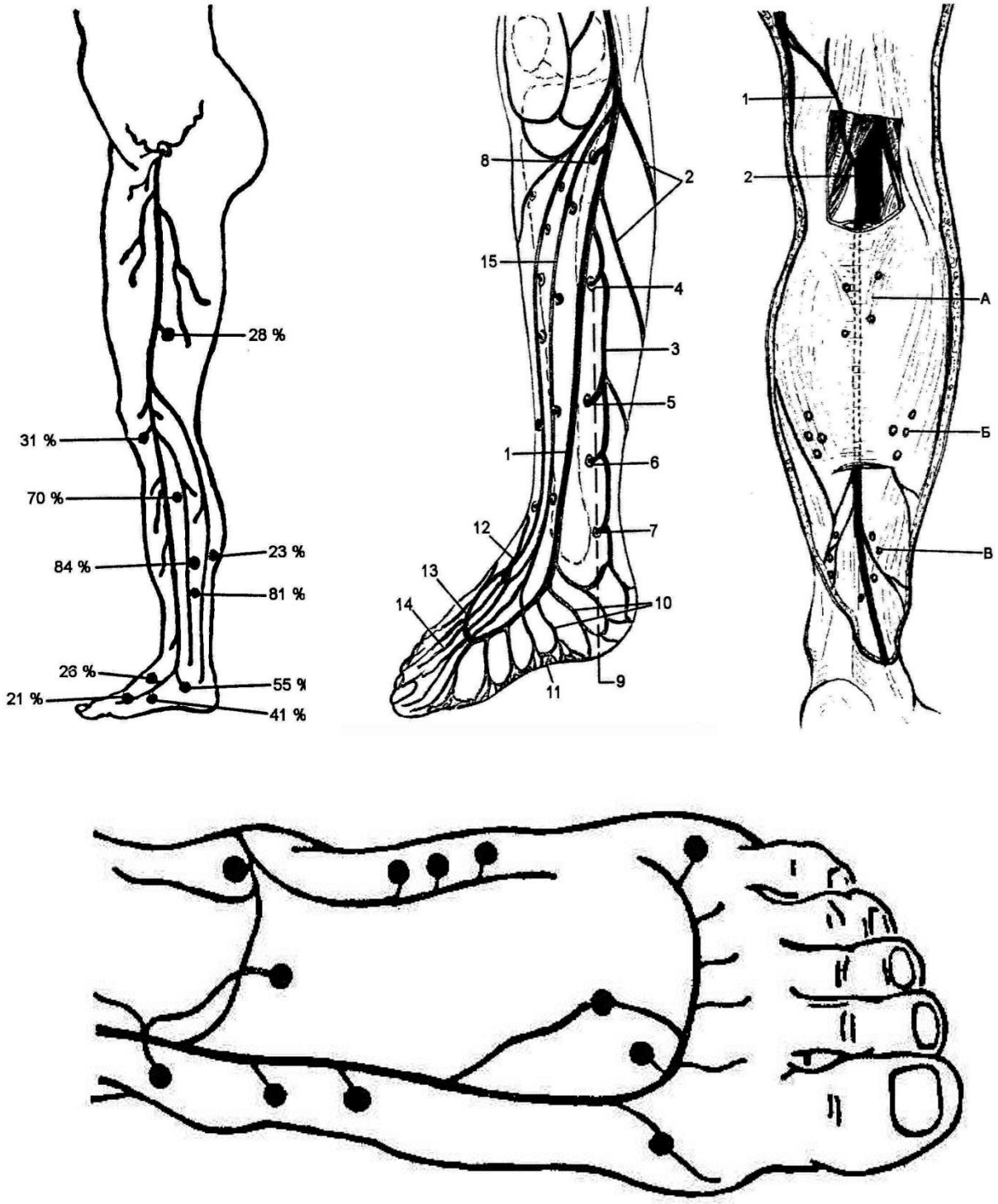
Pic. 1. The structure of the venous system of the lower extremity (front view).



Pic. 2. The structure of the venous system of the lower extremity (back view).

Veins that pass through the openings in the deep fascia of muscles are called perforating. The system of perforating veins connects the superficial venous system with the deep veins. Under physiological conditions perforating veins provide the flow of blood from the superficial veins to the deep. An exception is the foot, where about 50% of the perforating veins serve to drain out the blood from the deep veins into the superficial. The number, size and localization of perforating veins are quite variable

(pic. 3). The vast majority of perforating veins have valves that are located predominantly in the suprafascial portion of the vessel, but 56% of perforating veins on the foot, in physiological conditions, do not have valves.



Pic. 3. Localization of perforating veins.

The ability of a person to walk on two limbs determines a number of features of the lower extremities veins structure due to the influence of hydrostatic and hydrodynamic factors. Sharp pressure fluctuations determine the more pronounced

development of the muscle layer in these vessels. In the veins of the foot the muscular layer is more pronounced and the content of collagen and elastin is lower than in the venous vessels, which are located more proximally.

The specific features of the venous wall include:

- the presence of a thin wall, the thickness of which is from a tenth part to a third part of the artery wall thickness;
- the presence of a thin middle layer (media), which is containing of smooth muscle tissue;
- adventitia, which is containing of fibro-elastic connective tissue.

If we compare the structure of the wall of the superficial and deep veins with the corresponding diameteres, which are located on the same level, the superficial veins always have more developed smooth muscle layer.

The reservoir properties of veins are due to their ability to stretch. The expansion of the veins happen due to the stretching of the elastic elements of the wall. The limit of the stretching is determined by inelastic wall components - collagen fibers. The muscular elements of the veins wall determine their tone and affect on their elongation and volume.

An important feature of veins is the presence of venous valves in them, which provide an unidirectional return of blood to the heart. Valves are present in superficial and deep veins. They protect venules and capillaries from a sharp rise in pressure during "muscular pump" activity and sudden changes in venous pressure.

The return of blood from the lower extremities to the heart is assisted by a number of mechanisms:

- venous vascular tonus;
- venous valves;
- force of the heart muscle contractions;
- limb muscules contractions – "muscle pump";
- negative diaphragmatic pressure, breathing movements;
- limb arteries pulsation;
- intraabdominal pressure.

3. ETIOPATHOGENESIS OF CHRONIC VENOUS INSUFFICIENCY AND VARICOSE VEINS.

Chronic venous insufficiency is consist of all conditions of lower extremities that are caused by impaired venous circulation that is associated with primary or secondary varicose veins.

Varicose veins are called persistent irreversible expansion and extension of the veins, resulting in gross pathological changes of venous walls and their valvular system.

Risk factors:

- female gender (wider pelvis in women with significant lower limbs vein flexion when they inflow into pelvic veins; overflow of inguinal veins during menstruation; physiological changes during pregnancy.);
- sedentary lifestyle;
- overweight;
- age (with time the elasticity of the walls of the vessels decreases);
- genetic predisposition (genetically determined weakness of the venous wall and valve structure);
- peculiarities of professional activity (long work in forced sitting or standing position);
- overload associated with increased intra-abdominal pressure.

The initial mechanism for varicose veins disease is valve insufficiency, which can be due to the following causes:

- weakness of the venous wall muscles and increase of the vein lumen (relative insufficiency);
- valve flaps can be destroyed by a previous inflammatory process in the veins;
- as a result of primary alteration of the biochemical components of the vessel wall (endothelial dysfunction);
- due to the hemodynamic overload (arterio-venous fistulas).

The failure of the valves leads to the disorders of venous outflow and appearance of pathological refluxes according to their place of origin: in the large mouths of the superficial veins or in perforated veins. Stretching of the vein wall in the valve zone can cause incomplete closure of it, which is manifested by an overload of blood volume in the venous segment that lies below. Therefore, at occurrence of valve

insufficiency of veins subsequently there is an expansion of a zone of venous insufficiency in the distal direction.

Pathological blood reflux leads to increased venous pressure inside the vessel. The development of venous hypertension and the destruction of the valves lead to the progression of varicose veins with subsequent development of a cascade of pathological reactions.

Under the influence of venous hypertension the architecture of the capillary system undergoes significant changes. The amount of capillaries increases, the capillaries become sinuous like kidney glomeruli. Under the influence of the venous hypertension an overload of the venous system appears, venules gradually lengthen, which leads to the appearance of telangiectasia. The extreme manifestation of this process is acroangiodermatitis, the so-called "venous crown" of the foot in the area of the medial bone.

With the further progression of chronic venous insufficiency, the capillary system reduces and the dermis undergoes to sclerosing. The extreme manifestation of the capillary system reducing is the so-called "white atrophy" of the skin. In this condition the capillary system is practically absent, and in its remains numerous of thrombosis and fibrin deposits are found.

As a result of long-lasting venous hypertension increases the permeability of the venous wall and increases capillary filtration. These processes lead to an imbalance between hydrostatic and colloid osmotic pressure, which is manifested by swelling of the lower third of the shin.

Due to the progression of chronic venous insufficiency and under the influence of persistent interstitial edema, fibroblast activation is triggered, which leads to the progressive tissue sclerosis. The morphological picture of inflammation in the area of lipodermatosclerosis is represented by lymphocytic-macrophage infiltrates around the capillaries of the papillary layer of the dermis.

Sclerosing process is also undergoes to the tissues that localized below. Progressive fascia sclerosis promotes an atrophy of the shin muscles and their fatty dystrophy. Develop degenerative changes of the ankle, achilles tendon and fatty tissue of the foot. All these factors impair the function of the venous pump of the shin and promote the progress of chronic venous insufficiency.

4. CLINICAL MANIFESTATIONS OF VARICOSE VEINS.

The clinical symptoms of varicose veins of the lower extremities are quite diverse and depend mainly on the stage of the disease.

The main symptoms of varicose veins include the following:

- heaviness in the legs;
- lower extremity fatigue syndrome;
- periodical aching dull pain ("feeling of legs fullness");
- night cramping and paresthesias in the calf muscles;
- edema and pastosity of the extremities in the area of the ankle joints (soft at first, which disappears after a night's rest, in time becomes dense and resilient);
- cosmetical manifestations:
  - telangiectasias (enlargement of intradermal venules with a diameter <0.5 mm);
  - reticular varicose veins (enlargement of intradermal venules with a diameter of 0.6-2 mm);
  - varicose veins;
  - skin pigmentation (rust-brown, cyanotic tinge, foci of skin with "white atrophy");
  - inflammation of the skin and subcutaneous tissue;
  - lipodermosclerosis;
  - varicose eczema (dry or wet, accompanied by itching);
  - trophic ulcers (active or healed, usually in the lower third of shin near the medial bone).

Forms of varicose veins:

1. intradermal and subcutaneous segmental varicose without pathological veno-venous reflux;
2. segmental varicose with pathological reflux through the superficial and/or perforating veins;
3. spreaded varicose with pathological reflux through superficial and perforated veins;
4. varicose veins due to the presence of deep vein reflux.

In clinical and scientific studies, it is advisable to use **CEAP (Clinical, Ethiological, Anatomical, Patophysiological) International Consensus (1994)** to

determine in detail the properties of the pathological process, its localization and other major features of the disease.

Clinical picture (C) (pic. 4):

Stage 0 – no symptoms during the inspection and palpation;

Stage 1 – telangiectasias or reticular veins;

Stage 2 – varicose-veins;

Stage 3 – swelling;

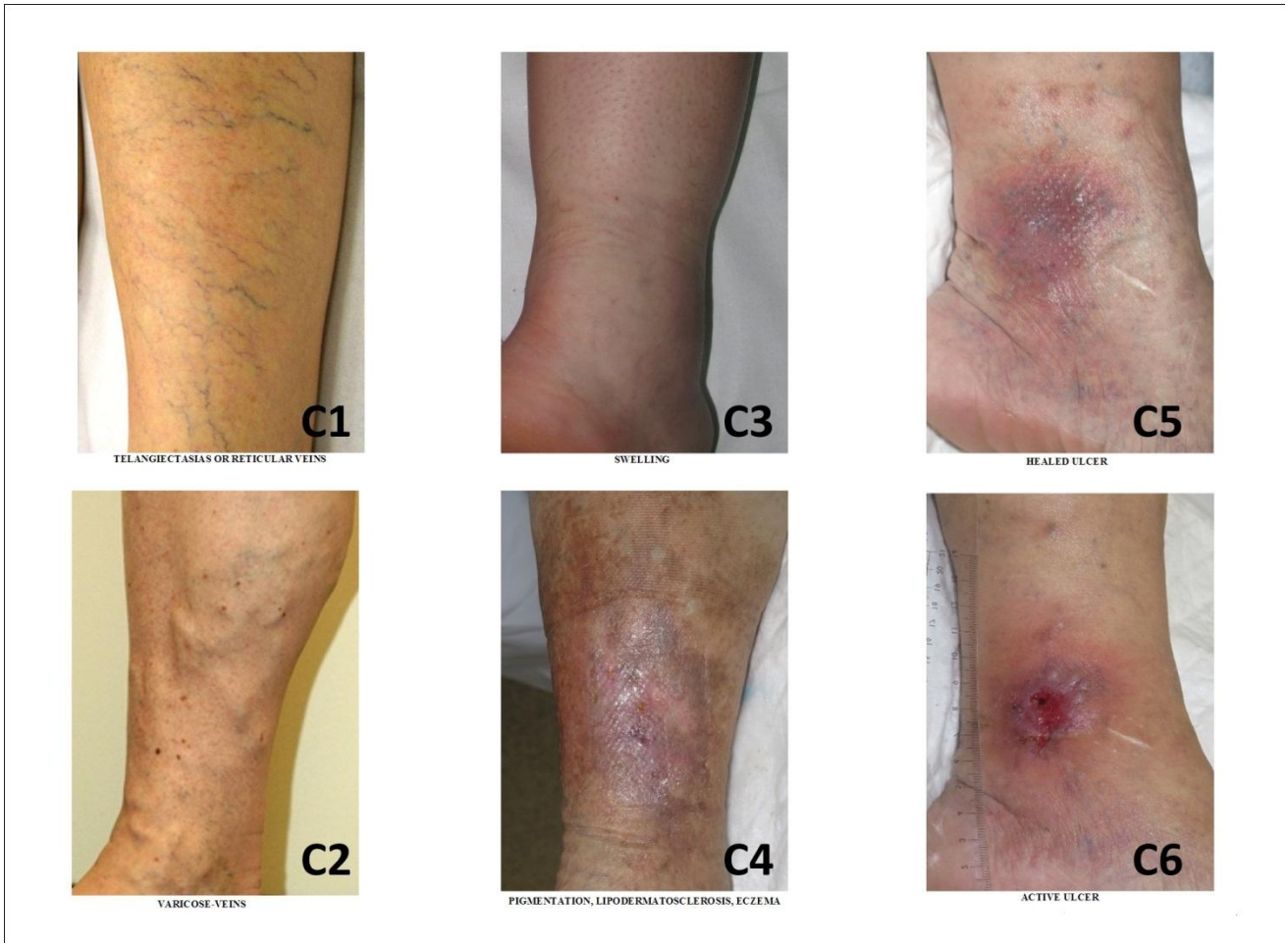
Stage 4 – changes of skin and subcutaneous fat:

4a – pigmentation and/or eczema;

4b – lipodermatosclerosis;

Stage 5 – skin changes mentioned above and an healed ulcer;

Stage 6 – skin changes above and active ulcer.



Pic. 4. Clinical picture of varicose veins.

Etiological classification (E):

Ec – congenital pathology;

Ep – primary vein disease;

Es – secondary (postthrombotic) vein disease;

En – no venous etiology is detected.

Anatomical classification (A):

As – superficial veins;

Ap – perforating veins;

Ad – deep veins;

An – no anatomical localization of the disease.

Pathophysiological classification (P):

Pr – reflux;

Po – obstruction;

Pro – reflux and obstruction;

Pn – pathophysiological disorders not identified.

Classification due to the degree of chronic venous insufficiency.

Degree	Stage of	Symptoms
0		No symptoms.
I	Compensation	Minor complaints (limb fatigue, feeling of heaviness and fullness in the legs ("heavy legs" in the evening), night cramping and paresthesias in the calf muscles, sometimes aching pain).
II	Decompensation	Pain become more severe, especially with prolonged standing or in the evening. Induration of the skin and subcutaneous tissue, changing the color of the skin, occurs hyperpigmentation - the skin is purple-cyanotic, sometimes black, there is eczema, joins unbearable itching.
III	Complications	Presence of active trophic ulcers or scars after healed ulcers. Joins limfangitis, frequently occurs erysipelas, which usually leads to limfostasis of the limbs.

Complications of varicose veins:

1. bleeding from varicose nodule;
2. thrombophlebitis;
3. limfangitis:
4. erysipelas;

5. DIAGNOSIS OF VARICOSE VEINS DISEASE.

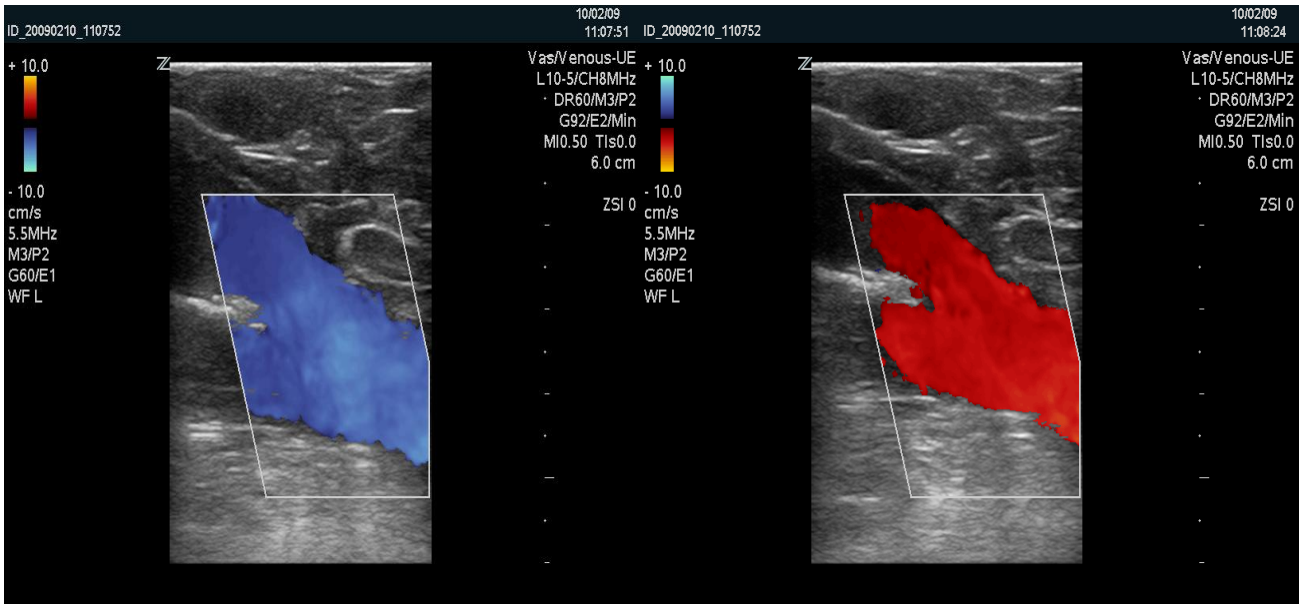
5.1. Ultrasound duplex scanning of the lower extremities veins.

Ultrasound duplex scanning today is the "gold standard" in the diagnosis of the lower extremities veins diseases.

The physical basis of ultrasound angioscanning is the different degree of reflection and absorption of the ultrasound wave by different tissues. The reflection of ultrasound occurs at the verge of the tissues separation with different values of acoustic resistance.

Ultrasound duplex scanning with color mapping of blood flow allows to reliably determine the anatomical and morphological changes of the venous system, which helps to choose an adequate treatment for varicose veins.

Color duplex scanning mode combines duplex scanning with color doppler mapping. Color doppler mapping consist in the overlay of different color-coded directions and velocities of blood flow on a two-dimensional (2D) image of the vessel (pic. 5). Red color indicates the direction of blood flow to the transducer, blue color - the movement from the transducer, light tones - high blood flow rates, saturated - low blood flow rates.



a) b)

Pic.5. a) antegrade blood flow on the sapheno-femoral joint; b) retrograde blood flow on the sapheno-femoral joint during the Valsalva's test.

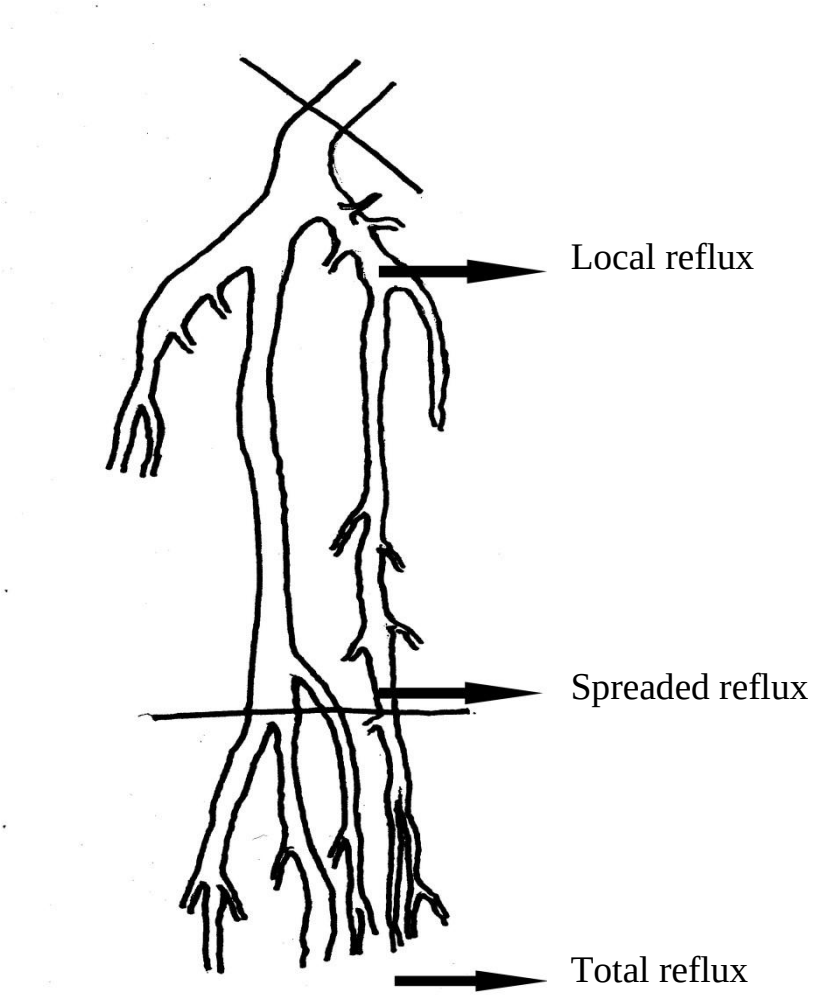
In patients with chronic venous insufficiency, the purpose of ultrasound is to study the anatomy of the venous system and venous outflow disorders in the lower extremity.

The valvular apparatus of veins is considered capable when at performance of Valsalva's test or at proximal compression test blood flow stops.

During echolocation of the large saphenous vein, ultrasound scanning allows not only to reliably detect the absence or presence of reflux, but also to detect its length.

Classification of vertical reflux in large saphenous vein (pic. 6):

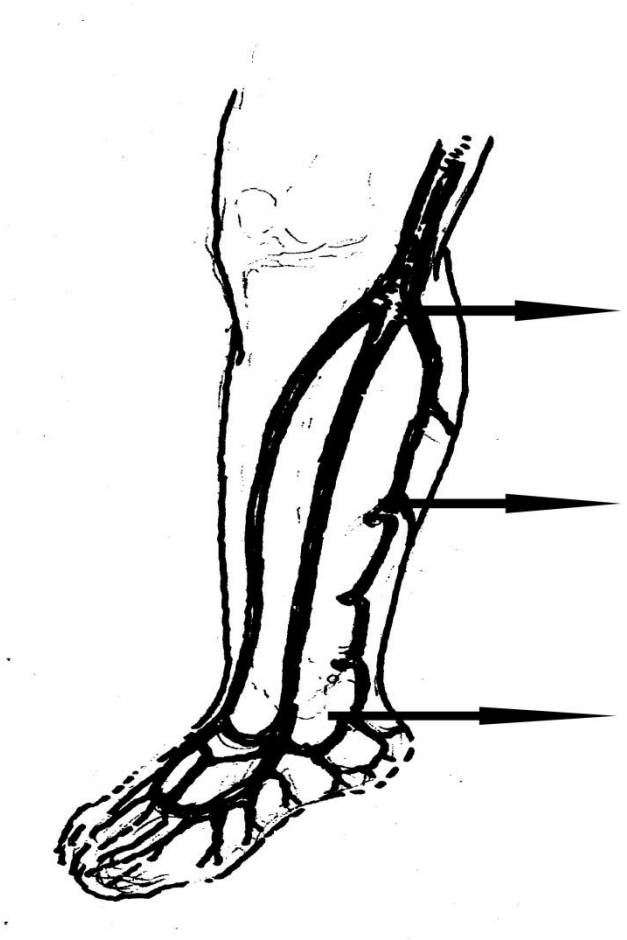
- Local – in the presence of reflux in the groin area from the mouth of large saphenous vein to the level of inflow of the medial accessory vein.
- Spreaded – from the ostial valve to the cleft of the knee joint, below the inflow of the small saphenous vein in the popliteal vein.
- Total – the vertical reflux that spreads from the ostial valve to the medial bone.



Pic. 6. Types of reflux in in large saphenous vein according to ultrasonography.

Classification of vertical reflux in small saphenous vein (pic. 7):

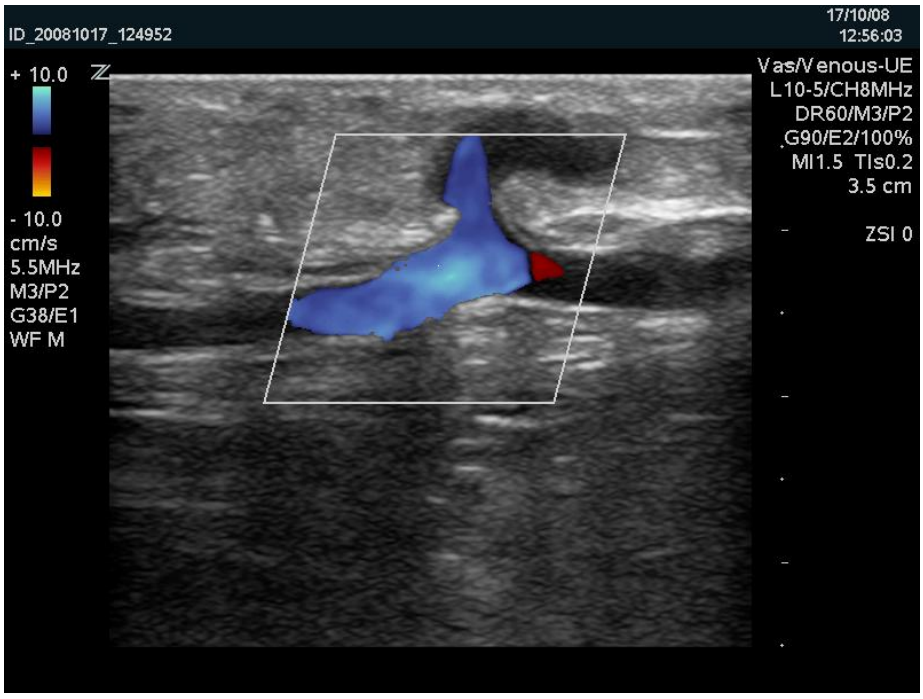
- Local – in the popliteal fossa, from the mouth of small saphenous vein to the knee cleft.



- Spreaded – from the mouth of small saphenous vein to the middle third of the shin.
- Total – from the mouth of small saphenous vein to the lateral bone.

Pic. 7. Types of reflux in small saphenous vein according to ultrasonography.

Ultrasound with color mapping of blood flow is recognized as the optimal way to accurately establish the location of perforating veins with valvular insufficiency (pic. 8).



Pic. 8. Cockett's perforating vein.

Perforating veins are more common on the shin than on the thigh, and their number increases with the development of the disease.

Extremely important for surgeons are data about the localization of perforating veins with valvular insufficiency, which cause the development of trophic ulcers.

During determination of the horizontal reflux on the thigh and shin, should be considered the number of incapable perforating veins.

Classification of horizontal reflux through the perforating veins:

- Single reflux – the presence of up to two perforating veins with valvular insufficiency.
- Multiple reflux – three or more perforating veins with valvular insufficiency within one segment.
- Total reflux – the multiple lesions of the perforating veins of the thigh and shin.

Nowaday, ultrasound duplex scanning of veins with color mapping of blood flow is an objective and universal non-invasive method of research in most cases of varicose veins disease.

The advantages of the ultrasound method of veins examination are non-invasiveness, accessibility, no radiation exposure, real-time imaging, determination of the functional state of the valve apparatus, the ability to assess the condition of the surrounding tissues.

A significant limitation of the ultrasound method is the study of tibial veins with severe tissue induration.

5.2. X-ray contrast phlebography.

For the distal ascending phlebography of the lower extremities veins use access through the veins of dorsal surface of the foot. The patient lies on his back on a trochoscope, which is inclined at an angle of 45 - 60˚. A harness should be placed over the lateral and medial bones. A needle with a diameter of 0.5 - 0.6 mm is used for puncture a vein of dorsal surface of the foot. Antegrade contrasting of shin veins is performed by introducing of 15-20 ml of 30-50% solution of contrast agent into the superficial veins of the foot or into the posterior tibial vein under the control of phleboscopy. When investigated veins are tightly filled with contrast medium a phlebography should be performed (pic. 9).

Pic. 9. Phlebogram of the lower extremity on which the Cockett's perforating veins with valvular insufficiency are visualized.

Diagnostic tasks of phlebography:

1) exclusion of postthrombotic deep vein lesions or determining the degree of recanalization of deep veins;

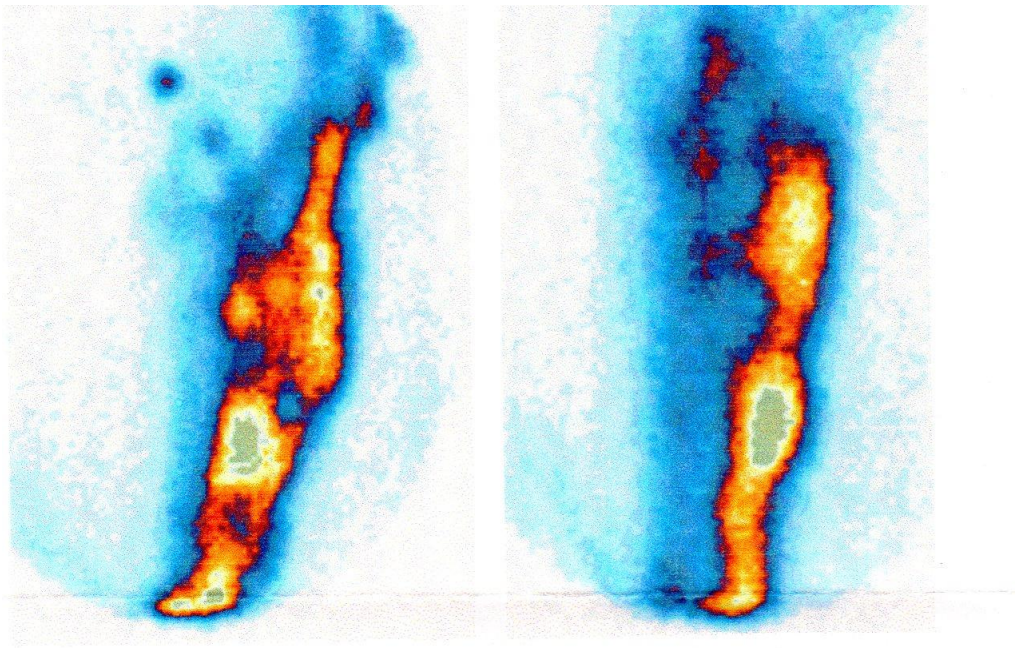
2) detection of localization of incapable perforating veins of the shin and the presence of retrograde contrast reset on them.

In the absence of postthrombotic changes, the deep veins are completely contrasted. Incapable perforating veins fill with contrast immediately after filling of the posterior tibial vein.

With the development of competitive non-invasive ultrasound techniques, the use of X-ray contrast phlebography has decreased, but its continues to be the "gold standard" in the diagnosis of deep vein patency of the lower extremities.

5.3. Radionuclide phleboscintigraphy.

Contrast of the lower extremity venous system is carried out with using of a short-lived isotope ^{99m} Tc – pertechnetate (pic. 10), which is bolus injected into one of the veins of the dorsal surface of the foot at a dose of 200 - 280 MBq with the preliminary imposition of a harness at the level of the lower third of the leg. The examination is performed in a vertical position.



Pic. 10. Phleboscintigram of deep and superficial veins of the tibia (medial and anterior surface).

The moving of the radiopharmdrugs with blood flow through the venous system is recorded by a detector of gamma-camera. The scanning duration of the shin segment is 60 seconds, popliteal and femoral is 30 seconds for each one. Then the area of interest is selected and the computer processes the information. An activity-time curve is created that displays the dynamics of radiopharmdrugs evacuation, calculates the linear and volumetric velocity of blood flow, the half-life of the radiopharmdrugs, as well as the evacuation index.

Using of this technique shows the patency of the deep, superficial venous systems and pathological blood flow through the incapable perforating veins.

This technique has a number of advantages over phlebography: small radiation load, much less trauma and no side effects. The only disadvantage of radionuclide phleboscintigraphy is the need for radiopharmdrugs and high cost of equipment.

6. CONSERVATIVE TREATMENT OF VARICOSE VEINS.

Tasks of conservative therapy of varicose veins:

- ✓ elimination of risk factors for the development of the disease (correction of lifestyle, nutrition, correction of overload on a job);
- ✓ improvement of phlebohemodynamics (elastic compression, therapeutic exercise, etc.);
- ✓ normalization of venous wall function (improving of the venous wall nutrition and venous outflow);
- ✓ correction of microcirculation, rheology and lymph outflow;
- ✓ elimination of inflammatory reactions.

Conservative therapy of varicose veins includes:

1. medicational treatment;
2. compression therapy.

6.1 Medicational treatment of varicose veins.

Medicational treatment is an integral part of conservative therapy for varicose veins and its used for the following aim:

- ➢ elimination of symptoms of chronic venous insufficiency and prevention of complications;
- ➢ prevention of recurrence of the venous system diseases;
- ➢ preoperative preparation of patients;
- ➢ postoperative rehabilitation;
- ➢ improving the quality of patients life.

Medications do not eliminate varicose veins. They affect the two main groups of symptoms that bother patients: swelling and discomfort in the legs.

Drugs that are used in the treatment of chronic venous insufficiency:

1. Phlebotropic drugs:
   - flavonoids (detralex, phlebodia, normoven, venoplant, phlego);
   - derivatives of rutin (venoruton, rutin, troxerutin, troxevasin);
   - saponins (anavenol, escuzan);
   - synthetic substances (glivenol, ginko-fort).
2. Non-steroidal anti-inflammatory drugs (NSAIDs) - ibuprofen, diclofenac, etc.
3. Preparations of systemic enzyme therapy - wobenzyme, phlogenzyme, etc.

4. Vasoactive agents and disaggregants - pentoxifylline, aspirin, dipyridamole, nicotinic acid derivatives, prostaglandins (PgE1).

5. Topical drugs:

- preparations containing heparin (esaven-gel, lioton-1000, etc.)
- NSAIDs (diclofenac gel, fastum gel)
- corticosteroids (celestoderm, flucinar, fluorocort, etc.)
- phlebotonics (venoruton-gel, ginkgo-gel, cyclo-3-ointment, etc.).

6.2. Compression therapy of varicose veins.

Compression therapy is a pathogenetically sound method of conservative treatment of varicose veins.

The effect of compression treatment is determined by a decrease of pathological venous capacity of the lower extremities. This happens due to compression of the venous intermuscular plexuses, superficial and perforating veins, improving of the functional activity of the valvular apparatus and due to the reduction of the veins diameter.

In a result, a reduction in edema, an increase in the fibrinolytic activity and an improvement in blood rheology are achieved by reducing the stagnation of the blood in the venous system.

Wearing of elastic bandages accelerate the venous circulation of the limb in 5 times, reduce phlebohypertension, which lead to disappearing of complaints.

Compression therapy is indicated for any degree of chronic venous insufficiency, regardless of its cause.

Contraindication to compression therapy are:

1. chronic obliterating diseases of the lower extremities arteries, when the regional systolic pressure in the posterior tibial artery is below 80 mm Hg;
2. phlegmasia (circulatory venous gangrene);
3. uncontrolled congestive heart failure;
4. abscesses;
5. infected phlebitis;
6. peripheral sensory neuropathy.

Equipment for compression therapy can be divided into bandages and compression jersey.

6.2.1. Compression bandage.

Compression bandages can be inelastic (limited stretching) and elastic (long-stretching bandages). The extensibility of a bandage is determined by the change in the length of the bandage when it is stretched.

All bandages used for compression therapy should be placed on top of a soft pad to prevent rubbing and damage, caused by pressure in the projection of bone protrusions and tendons, distributing the pressure over a larger area.

Bandages should usually be applied from the toes to the popliteal fossa (pic. 11). The limb is bandaged in a bed in the morning until the swelling appears.

Pic. 11. Methods of proper bandaging of the lower extremities.

Alternatives can be short circular bandages with velcro, or double compression stockings with a clasp (pic. 12).

a) b)

Pic. 12. a) short circular bandages with velcro; b) double compression stockings with a clasp.

6.2.2. Compression jersey.

Nowaday, elastic jersey is divided into 4 classes (depending on the degree of compression):

I class: 15-21 mm Hg
II class: 22-32 mm Hg
III class 33-46 mm Hg
IV class: more than 46 mm Hg

Different manifestations of chronic venous insufficiency need different degrees of compression for treatment.

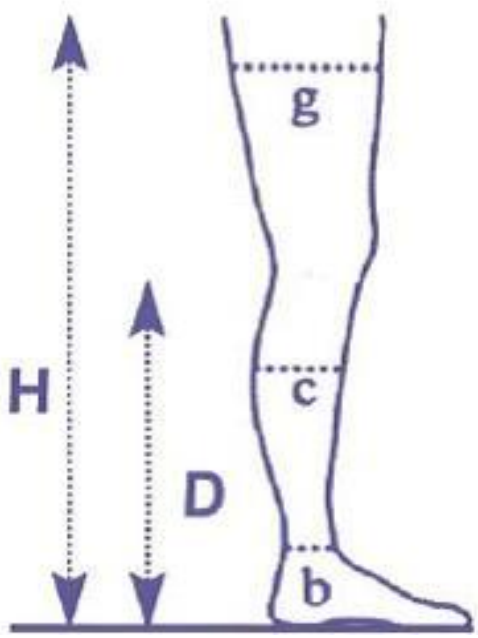
Recommended pressure for the treatment of venous diseases.

Clinical indications	**Recommended pressure in the ankle area, (mm Hg)**
Superficial or early varicose veins	14 – 17
Varicose veins of moderate severity, prevention of mild edema, treatment of ulcers	18 – 24
Severe varicose veins, severe edema, postthrombotic syndrome, treatment and prevention of ulcers	25 – 35

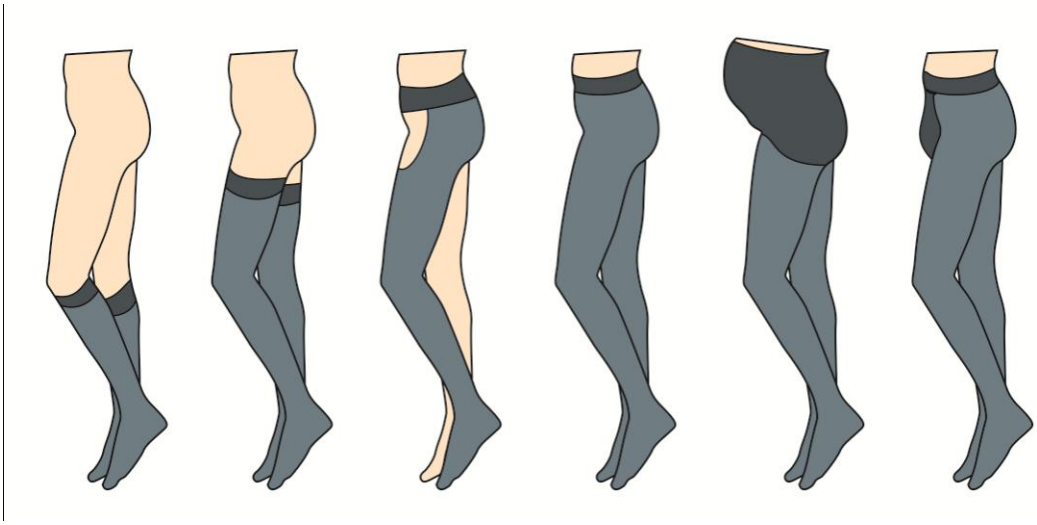
The use of jersey with I or II compression class in patients with chronic venous insufficiency reduces the volume of the lower extremity by 55-70 ml. Any

compression jersey that create a pressure less than 14 mm Hg is preventive, not curative.

Compression jersey must clearly correspond to the individual parameters of the patient. Medical jersey for each patients are always selected according to a special size table (pic. 13) and also select the required type of jersey (pic. 14). The tables for determining the size of compression stockings are based on the lengths of the circles of the ankle, shin and upper third of the thigh.



Pic. 13. Necessary parameters for selection of compression jersey.



a) b) c) d) e) f)

Pic. 14. Types of compression jersey: a) socks; b) stockings; c) stocking for one leg with a belt; d) tights; e) tights for pregnant women; f) tights for men.

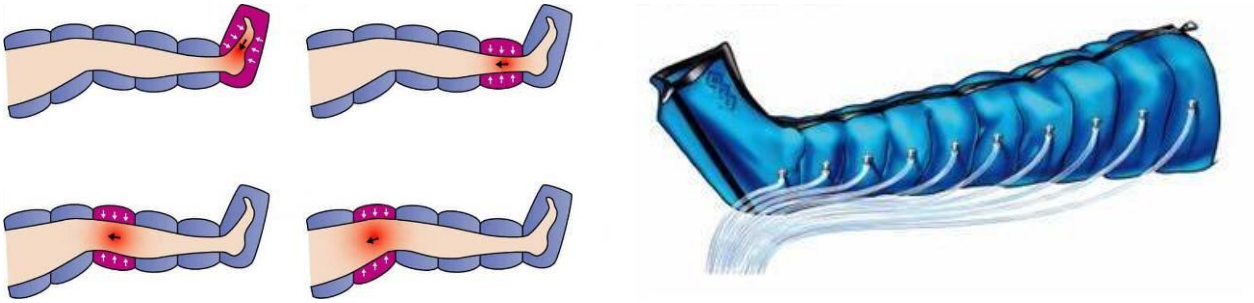
To obtain a medical effect, compression jersey must be worn regularly, otherwise, its healing properties are simply impossible to implement.

The result of proper compression therapy is the normalization of the function of the muscular-venous pump of the lower extremities, the improvement of hemorheology and microcirculation. This eliminates such manifestations of chronic venous insufficiency as heaviness, cramps in the calf muscles, reduces swelling of the extremities, creates favorable hemorheological conditions for the healing of trophic ulcers and the elimination of the phenomena of "aggressive" cellulite.

6.2.3. Pressotherapy.

Pressotherapy (impulse barotherapy) is a type of compression therapy that uses the effect of compressed air, that is supplied through special corsets, on the lymphovenous system.

This is a method of hardware physiotherapy, in which there is a mechanical effect on the underlying tissues, resulting in the displacement of excess extracellular fluid from them – lymphatic drainage. This type of therapy is used to relieve edema, which could not be reduced by tight bandages and compression jersey (pic. 15).



Pic. 15. Schematic representation of pressotherapy.

Pressotherapy with constant use of compression therapy can accelerate the elimination of symptoms of chronic venous insufficiency. This is especially useful for patients with limited mobility and in cases with concomitant arterial pathology, as this method helps to reduce edema and increase arterial blood flow, improves hemodynamics and endothelial function.

7. SURGICAL TREATMENT OF VARICOSE VEINS.

The indication for surgical treatment is a pathological flow of blood from the deep venous system into the superficial. The absolute indication for surgery in varicose veins should be considered the progression of chronic venous insufficiency with the manifestation of trophic disorders and complications (bleeding, thrombophlebitis).

Principles of surgical treatment:

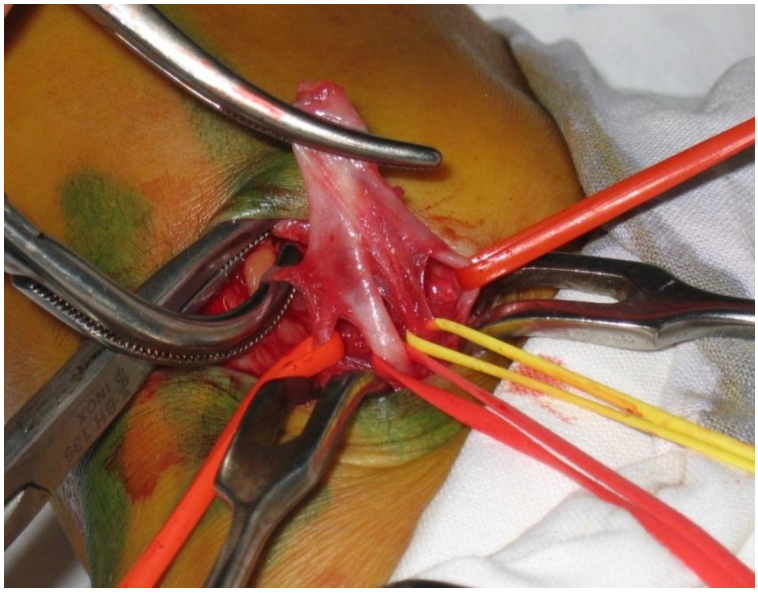
1. Elimination of pathological reflux from deep veins to the superficial.
2. Elimination of varicose-deformed superficial veins.

Tasks of surgical treatment of varicose veins:

1. elimination of symptoms of chronic venous insufficiency;
2. minimization of trauma during surgical intervention while maintaining its radicalism;
3. the maximal reduction of postoperative rehabilitation terms of patients.

Removal of subcutaneous veins is the main stage of the operation to eliminate varicose syndrome. The Trojan-Trendelenburg operation in combination with the Babcock's operation is the most often used type of surgery. They can be supplemented with various surgical methods or injectable sclerosing treatment in the postoperative period.

The Trojan-Trendelenburg operation (crossectomy) – ligation of the main trunk of the large saphenous vein at the confluence into the femoral vein and ligation of its branches (pic. 16).

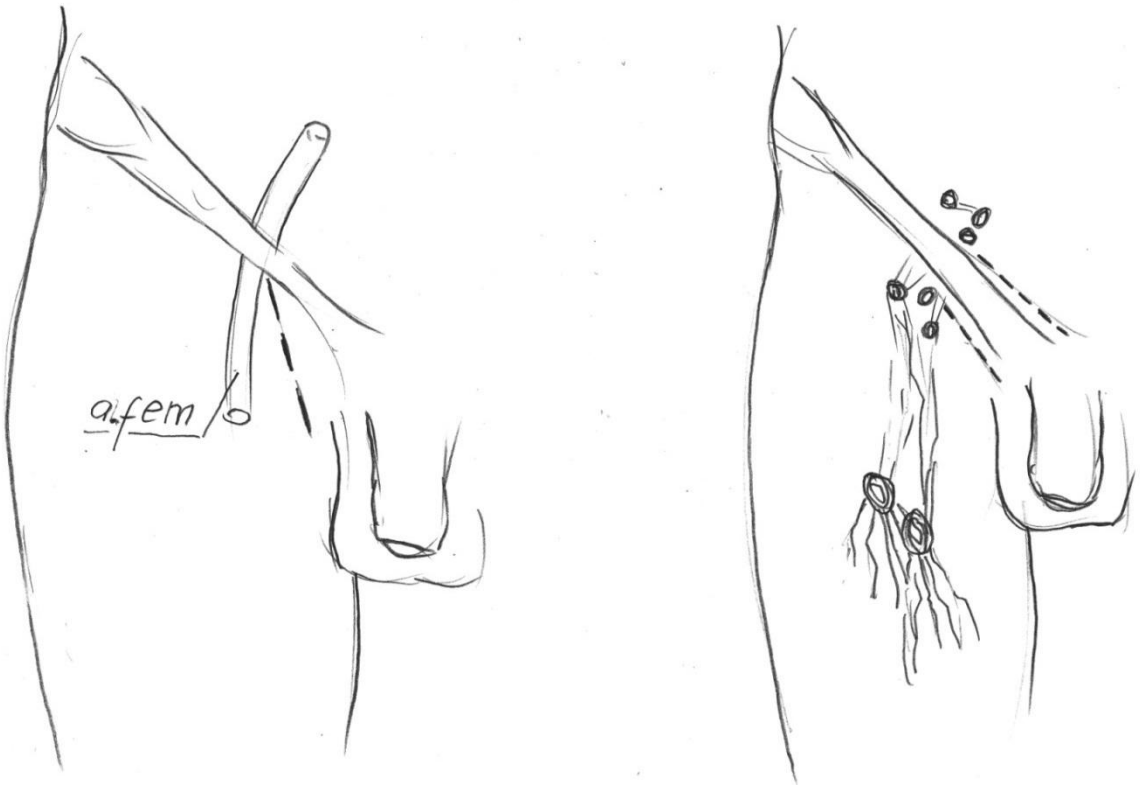


Pic. 16. Isolated and crossed main large saphenous vein trunk and isolated branches that flowing into it (crossectomy).

For crossectomy is performing one of the inguinal accesses:

1. obliquely-longitudinal access by Chervyakov (pic. 17 a). Chervyakov's access has a high risk of the damage to the Rosenmüller-Pirogov lymph node, that can leads to the development of postoperative lymphorrhea and the formation of postoperative infiltrates.

2. Bruner's access (pic. 17 b), in which the skin incision is made along the inguinal fold. Bruner's access significantly reduces damage to the external genital artery, which lays over the trunk of the large saphenous vein, and minimizes damage to the lymphatic collectors.



a) b)

Pic. 17. a) access by Chervyakov; b) Bruner's access.

The main point of surgery is not to leave a long stump of the large saphenous vein. A long stump can become a condition for recurrence of the disease or the place of blood clots formation, with a possible subsequent dangerous pulmonary embolism.

Babcock's operation – removal of the large saphenous vein from the groin area to the ankle (long stripping) or only the femoral segment (short stripping) using a special probe (venextractor) (pic. 18, 19).

Pic. 18. Long and short stripping.

Pic. 19. Removed large saphenous vein.

The imperfection of this operation is indicated by its high trauma, manifested by prolonged pain and postoperative edema. These symptoms are associated with trauma to the lymphatic system, trauma to the cutaneous nerves, which leads to paresthesia of the skin, which occurs in 50-80% of cases.

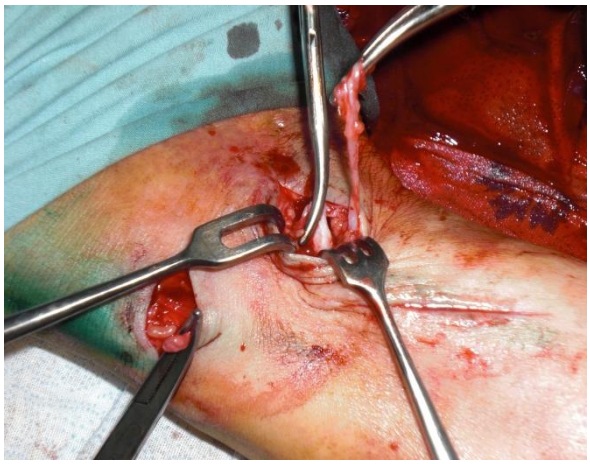
Narat's operation – removal in the subcutaneous tunnel of varicose branches of the large saphenous vein from small skin incisions along the veins.

Ligature methods:

1. *Klapp-Sokolov method* – subcutaneous ligation of veins.
2. *Schede-Kocher method* – subcutaneous ligation of veins with using of a gauze ball.

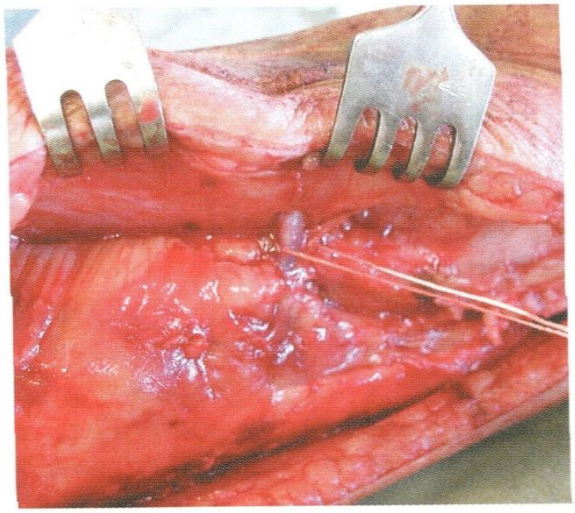
Elimination of horizontal reflux involves the separation of superficial and deep venous systems in areas of abnormal blood flow. For this the following surgical interventions are used:

Cockette's operation – a suprafascial ligation of perforating veins (pic. 20). The main point of the intervention is the allocation of the perforating vein to the place of its passage through the own fascia of the shin into the subfascial space.



Pic. 20. Suprafascial ligation of perforating veins by Cockett.

Linton's operation – subfascial ligation of perforating veins – is performed in case of severe induration of the skin (pic. 21).



Pic. 21. Subfascial ligation of perforating vein on a shin during Linton's operation.

Frequent postoperative complications are possible after Linton's operation: wound suppuration; marginal necrosis of the skin; persistent lymphedema caused by damage to the medial lymphatic collector.

Felder's operation – subfascial ligation of perforating veins with access on the posterior surface of the shin.

In cases of severe trophic disorders, access to the perforating veins should be outside the trophic disorders.

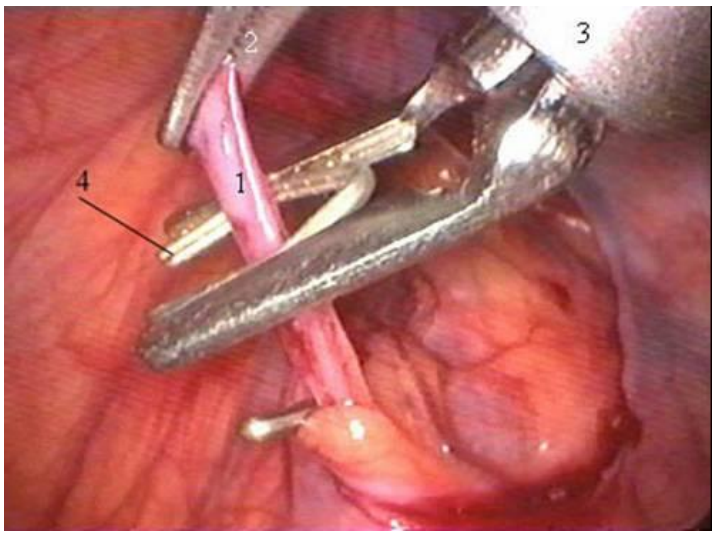
Immediate elastic compression of the lower limb is required after all kinds of surgery.

Disadvantages of standard venectomy:

1. Duration and complexity of the intervention.
2. Lack of cosmetics.
3. Prolonged hospital stay due to a large number of complications.
4. Sufficiently high recurrence rate.
5. A significant number of contraindications for surgery.
6. Long period of temporary incapacity for work and rehabilitation.

8. SUBFASCIAL ENDOSCOPIC PERFORANS SURGERY.

SEPS – subfascial dissection of perforating veins under endoscopic control (pic. 22). SEPS is performed taking into account the topographic features of the shin subfascial spaces structure. Carrying out of an endoscope strictly on tunnels provides low-traumatic preparation and safe mobilization of all perforating veins with valve insufficiency.



Pic. 22. Endoscopic clipping of perforating vein

SEPS is used to treat patients with trophic complications of varicose and postthrombophlebitic diseases, even with active trophic ulcers.

Before the operation, the localization of incapable perforating veins is detected by ultrasound duplex scanning with color mapping of blood flow.

For surgical access performed the skin incision 3-5 cm long at 5-7 cm proximal to the area of trophic disorders.

Pic. 23. Performing of SEPS from posterior access.

There are the following types of access:

- Medial access is required for revision of the posteriomedial subfascial space and dissection of perforated veins with valvular insufficiency.
- Lateral access is necessary for revision and crossing of penetrating veins in the lateral and posterolateral subfascial spaces.
- Posterior access (pic. 23) is used when necessary to revise the entire subfascial space in terms of circular trophic disorders.

9. ENDOVENOUS TREATMENT.

Methods of endovenous treatment of varicose veins include laser ablation and radiofrequency ablation.

Endovenous laser ablation (EVLA) is a method of treating varicose veins aimed at eliminating pathological blood reflux in superficial veins by use of radiation of a laser thermal energy. The principle of EVLA is based on the thermal effect of a laser pulse, which contributes to the damage of the venous walls and the formation of steam micro-bubbles in the blood, which coagulate proteins in the subendothelial layers of blood vessels. During this process, the internal lumen of the vein is damaged and a stable thrombus is formed in its lumen. After 3-6 months, this thrombus turns into a thin connective dysfunctional venous cord, and then it can dissolve on its own.

Radiofrequency ablation (RFA) is a modern low-traumatic method of treating varicose veins of the lower extremities, the principle of which is based on the effect of high-frequency currents on the venous wall followed by its gluing.

Advantages of endovenous treatment over the traditional surgical method:

• Absence of skin incisions, sutures, and the need for regular dressings during the postoperative period.

• Absence of general anesthesia or spinal anesthesia.

• The method minimizes the possibility of bleeding, blood loss, because the vein is immediately welded, and small capillaries are cauterized.

• Minimal pain.

• High cosmetic effect.

• It is carried out without hospitalization, stay in the hospital is no more than 3 hours.

• 30 minutes after the end of the procedure, the patient can leave the clinic.

• Ability to walk long distances (5-6 km) the day after the procedure.

• Possibility of quick return to sports (after 1-2 days).

Methodology of the intervention.

Before the procedure, the doctor performs an ultrasound examination of the veins of the lower extremities, during which he makes markings on the skin. Endovenous treatment of the lower extremity varicose veins takes from 30 to 60 minutes, depending on the extent of the intervention. All manipulations are performed under the ultrasound control.

Access to the refluxing superficial vein is obtained with a 16 or 18 F needle under ultrasound guidance at the lowest point of its incompetence. In general, the point of access is limited to 15 cm distal to the knee joint. The radiofrequency ablation (or

laser ablation) catheter is then advanced under ultrasound guidance and placed at least 2 cm distal to the saphenofemoral junction. Once the catheter is in place, a tumescent anesthetic solution is injected around the vein under ultrasound guidance along the entire course of the vein. The tumescent anesthetic solution usually contains epinephrine, bicarbonate, and lidocaine. An example of a tumescent anesthetic would be a combination of 0.5 mg adrenaline or epinephrine, 4.2 mg bicarbonate, and 35 ml lidocaine diluted in 500 ml 0.9 percent saline.

This serves to insulate the surrounding soft tissue, nerves, deep vessels from heat injury. It also helps compress the target vein, thereby increasing contact of the heating element on the catheter with the vein walls. The radiofrequency (or laser) generator is then activated, which results in segmental heat energy of 120 degrees Celsius being applied.

At the end of the procedure, hemostasis is achieved by manual compression at the site of venous access and catheter entry. Compression bandages and stockings are then applied on the treated leg for 1 to 3 days to reduce post-procedure bruising, tenderness. Patients are encouraged to walk after the procedure. Follow-up protocols vary by institution. In general, between 1 and 3 days, patients undergo repeat venous ultrasound. This ensures successful occlusion of the treated vein and confirms the absence of deep venous injury. The patient then also undergoes a repeat clinical evaluation in 1 to 3 weeks.

After endovenous therapy of varicose veins, compression stockings are recommended for continued regular use. The duration of compression stocking is guided by clinical judgment.

Contraindications to endovenous treatment:

• Implanted pacemaker.

• Allergy to local anesthetic.

• Blood coagulation disorders (PE in history).

• Pregnancy.

• Injection drug addiction.

• History of acute thrombophlebitis of the great saphenous vein trunk.

• Technical impossibility of performing the intervention (excessive tortuosity of the trunk of the varicose vein and / or the presence of large varicose nodes along the course of the vein trunk).

Risks and possible complications include the following:

- Bleeding
- Infection

- Blood clots
- Damage to the nerves in the treated area
- Irritation or burning of the skin over the treated vein
- Treatment doesn't improve the look or the symptoms of the problem veins
- Risks of any medicines used during the treatment

Rehabilitation after intervention.

The patient is recommended to wear compression underwear, be sure to walk at least 5-6 km a day. It is not recommended to visit a sauna or a bathhouse. It is necessary to temporarily limit significant physical exertion. After 2-3 weeks, the recovery period is considered complete.

10. SCLEROTHERAPY OF VARICOSE VEINS.

Sclerotherapy is the sequential elimination of intradermal or subcutaneous varicose veins by introducing a sclerosing drug into their lumen.

There are two types of sclerotherapy:

1. cosmetico-therapeutic sclerotherapy;
2. catheter-used trunk scleroobliteration.

Cosmetico-therapeutic sclerotherapy.

The popularity of this method of treatment is due to its simplicity, the possibility of performing in an outpatient setting and a good cosmetic effect.

Indications for performing are:

1. Intradermal varicose veins or telangiectasia (C1-CEAP).
2. Reticular varicose veins (C1 - CEAP).
3. Varicose of the large and small saphenous vein branches (provided that the function of the valves are preserved in large and small saphenous vein).
4. Recurrence after surgery for varicose veins.
5. Incapable perforating veins in the area of trophic changes.

For the treatment of telangiectasia and reticular varicose veins is used a conventional liquid phlebosclerosing drug or convert it to a state of fine foam by the method of "foam-form" according to Tessari. Under visual control, a vein puncture is performed and a sclerosant is injected (pic. 24).

Pic. 24. Performing of reticular varicose veins sclerotherapy.

Only sclerosant in the form of fine foam is used to perform sclerotherapy of varicose branches and perforating veins.

Under the control of ultrasound, a puncture of a varicose vein or an incapable perforating vein is performed and sclerosant is injected (pic. 25).

Pic. 25. Sclerotherapy of an incapable perforated vein under ultrasound control.

After the manipulation, it is necessary to compress the limb with an elastic bandage or compression jersey.

Catheter-used trunk scleroobliteration.

Catheter-used trunk scleroobliteration – mini-invasive method of catheter-used scleroobliteration of the large and small saphenous veins trunks with sclerosant.

Indications for performing are:

- small diameter of the large and small saphenous veins;
- the presence of contraindications to venectomy;
- at the expressed trophic changes of a shin after performance of short stripping on a hip.

Crossectomy should be performed before performing subcutaneous vein scleroobliteration.

There are two ways to perform catheter-trunk scleroobliteration:

1. After performing a crossectomy, a polyethylene catheter with a diameter of 2-3 mm is inserted into the vein lumen in the distal direction (pic 26). Near the medial bone allocate the initial section of the large saphenous vein. The vein is crossed and ligated. Sclerosant is then injected through the catheter, pulling its distal end outward. The catheter is removed, the vein is ligated, and the wound is sutured.

Pic. 26. Preparation of sclerosant for administration in the distal direction.

2. After crossectomy, the main trunk of the large saphenous vein is ligated. Near the medial bone allocate the initial section of the large saphenous vein. The vein is crossed, the distal end is ligated, and a catheter is inserted into the proximal antegrade direction into the trunk of the vein (pic. 27). Pulling the proximal end the catheter is removed to the outside and through its lumen enter sclerosing substance. The catheter is removed, the vein is ligated, and the wound is sutured.

Pic. 27. Antegrade administration of sclerosant.

To ensure the contact of the walls of the vein with each other immediately put on the limb elastic bandage with a gauze roller or latex pillows along the vein (pic. 28).

Pic. 28. Putting of the elastic bandage with a gauze roller on a limb.

Only with a sufficiently tight bandage and the exact location of the gauze roller in the projection of the vein reach its complete obliteration.

Complications after sclerotherapy:

- Early (urticaria, allergic reactions, pain syndrome).
- Late (thrombophlebites, skin necrosis).

11. ACUTE THROMBOPHLEBITIS.

Acute thrombophlebitis – is a complication of varicose veins of the lower extremities, characterized by the formation of blood clots in the lumen of a vessel against the background of an inflammatory process in its wall.

The inflammatory process in the venous wall and paravasal structures in acute thrombophlebitis is usually aseptic in nature.

In most cases, the causes of thrombosis in varicose veins are the following pathogenetic mechanisms: changes in the venous wall (atony of the vein wall due to overstretching and expansion, loss of endothelial integrity), slowing of blood flow, change from laminar to turbulent blood flow.

Acute thrombophlebitis carries the threat of the spread of thrombotic masses to the deep venous system and the development of pulmonary embolism (PE).

Clinically, acute thrombophlebitis is manifested by the presence of a dense painful hyperemic mass along the course of superficial varicose veins with local swelling of the surrounding tissues.

The gold standard in the diagnosis of thrombophlebitis is ultrasound with color mapping. Ultrasound signs of thrombosis are:

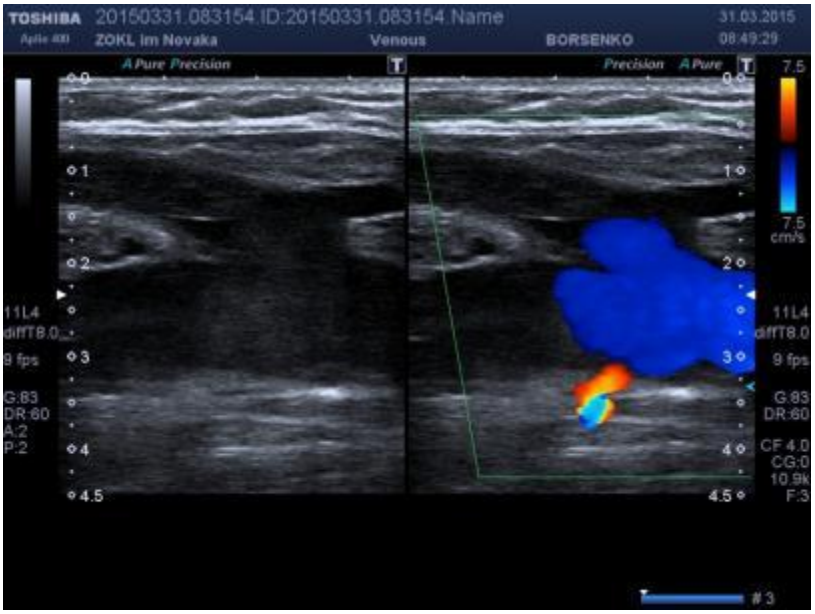
a) an increase in the diameter of the vessel
b) the presence of thrombotic masses in the lumen,
c) lack of reaction to compression by the sensor,
d) lack of blood flow during spectral or color dopplerography.

The wall of the vein in acute thrombophlebitis is rigid, compacted, and has the appearance of a hyperechoic structure. The surrounding tissues are diffusely compacted, with indistinct contours of structural elements (pic. 29).

a) b)

Pic. 29. Ultrasound - a great saphenous vein is filled with thrombotic masses: a) longitudinal section; b) cross section.

A sign of the thrombus floating is the symptom of "washing" its tip with blood flow. This sign is registered in the mode of color or energy coding (pic. 30).



Pic. 30. The head of a floating thrombus at the mouth of a great saphenous vein.

The main goals in the treatment of acute thrombophlebitis are:

1. Prevention of the thrombus and the inflammatory process spreading through superficial and perforating veins to the deep venous system, to reduce the risk of PE.
2. Prevention of repeated thrombosis in subcutaneous veins.
3. The use of minimally traumatic operations that combine radicality and cosmeticity.

12. VENOUS TROPHIC ULCERS.

An ulcer is called a skin defect that opens after the rejection of necrotic tissues, when destructive processes prevail over restorative ones due to impaired blood supply. Trophic disorders of venous genesis are characterized, as a rule, by long-term treatment, chronic course of the wound process, sluggish granulation and delayed marginal epithelization.

The main reason for the development of venous trophic ulcers is a violation of venous blood circulation, which occurs in varicose veins and post-thrombotic syndrome. As a result of valvular insufficiency of subcutaneous, penetrating and deep veins, blood outflow from the extremities is disturbed, which is manifested by the formation of persistent pathological "vertical" and "horizontal" reflux. Due to these hemodynamic changes chronic venous hypertension is formed, which initiates a further chain of pathological reactions, leading to trophic changes and ulcers (pic. 31).

Pic. 31. Trophic skin changes of the shin with an ulcer.

12.1. Pathophysiology of the wound process.

The wound process is a complex of various protective reactions that develop in the body in response to tissue damage and is manifested in the form of destructive and regenerative processes in the wound area and general reactive changes of the body.

As a result of morphological studies, three stages of the wound process were identified.

Stage of exudation (necrosis, cleaning). Leukocytes (neutrophils, lymphocytes, macrophages) enter the wound, phagocytosis of bacteria occurs, autolytic cleaning of the wound from necrotic masses.

Stage of proliferation (granulation). Fibroblasts migrate into the wound and synthesize collagen, the wound is filled with temporary tissue - granulations formed

from a large number of capillary loops. Later, fibroblasts turn into fibrocytes and myofibrocytes, which provide tightening of the edges of the wound.

The stage of epithelization and scarring. Keratocytes cover the wound, emerging from the edges and gradually covering the entire surface with epithelium. Granulation tissue transforms into scar connective tissue.

In clinical practice, a "visual" classification of the wound process stages is used. It is based on the changes in the appearance of the wound and three degrees of exudation - the BYRP (Black Yellow Red Pink) classification (Krasner, 1995). According to it, four stages of the wound process are distinguished (pic. 32. a, b, c, d).

a)

b)

c)

d)

Pic. 32. BYRP classification of the wound process stages: a) B (Black); b) Y (Yellow); c) R (Red); d) P (Pink).

In this system, different colors simulate different phases of the wound process: B (black) – necrosis, Y (yellow) – fibrin in the wound, R (red) – granulation tissue, P (pink) – epithelization of the wound. The color of the wound changes depending on the processes taking place in it.

12.2. Methods of assessing the condition of trophic ulcers.

When assessing the condition of an ulcer, attention is paid to a number of signs that characterize the bottom of the ulcer, its edges, and the skin around the defect.

The evaluation of a trophic ulcer takes into account:

– the nature of the granulation tissue at the bottom of the ulcer; its color and grain;

– the presence of deposits and their nature (fibrin, pus);

– the presence of marginal and median epithelization;

– the presence of discharge ("-" no exudation, "+" moderate discharge, "++" profuse exudation), as well as its nature (serous, purulent, mixed);

– swelling (absent, mild, moderate, severe);

– condition of the surrounding skin (unchanged, atrophic changes, hyperemia, maceration);

– the presence of necrotic tissues.

A computer program for processing digital images is used to assess the dynamics of healing and planimetry of ulcers. First, a photo of the ulcer is taken with a contact sterile centimeter tape for scaling. The image of the ulcer is transferred to the computer, where, according to the program, the area of the trophic ulcer is calculated (pic. 33).

a) b)

Pic. 33. Computer planimetry of the trophic ulcer area a, b.

12.3. Treatment of venous trophic ulcers.

Treatment of trophic ulcers of venous etiology can be divided into two stages. The first stage is the closure of a trophic ulcer using conservative measures. The second includes measures aimed at prevention of relapse.

Treatment of venous trophic ulcers should include the following main components:

– Correction of lifestyle (diet, regime).

– Systemic pharmacotherapy (nonsteroidal anti-inflammatory drugs, phlebotonics, anticoagulants, antibiotic therapy according to indications, antihistamines).

– Elastic compression of the lower extremities (elastic bandaging, compression knitwear).

– Local therapy of ulcers.

– Surgical treatment of chronic venous insufficiency.

Complex conservative treatment of venous trophic ulcers involves the following directions: taking systemic drugs, elastic compression, physiotherapeutic treatment, local therapy of trophic ulcers, compliance with the rules of behavior and the patient's regimen.

12.3.1. Local treatment of trophic ulcers.

Treatment of venous trophic ulcers should be as atraumatic as possible.

In the treatment of trophic ulcers, jet washing of its surface with a sterile physiological solution heated to 37 °C can be considered optimal. The main benefit of wounds washing is associated with mechanical removal of wound secretions and bacteria.

Suppression of infection and inflammation is carried out at the expense of local and systemic antibacterial and anti-inflammatory therapy, sanitation and physical methods of exposure on the wound (surgical cleaning, curettage, ultrasonic cavitation, wound treatment with a pulsating jet, laser irradiation, biological remediation, vacuum therapy).

Indications for antibacterial therapy are objective signs of infection of trophic ulcers (purulent discharge, acute inflammation of the surrounding skin, pyoderma, lymphangitis and lymphadenitis). Antibacterial therapy is carried out based on the results of a microbiological study.

Surgical cleaning, or debridement (necrectomy), is performed in the presence of a large amount of necrotic tissue and fibrin.

After necrectomy and remediation, further management of the wound is carried out according to the stage of the wound process with the help of dressings. The modern approach to local treatment of wounds consists in the fact that special modern materials should provide an environment optimal for healing in the wound.

Dressing materials can be conditionally divided into three groups:

1. Classic gauze.
2. Atraumatic materials:

– atraumatic mesh (without drugs and which containing ointments, gels).
– adsorbent bandages.
3. High-tech materials:
– alginates;
– hydrophilic fiber;
– hydrocolloids;
– hydrogels;
– bandages made of polyurethane foam (spongy without drugs and impregnated with antibacterial substances).

12.3.2. Additional methods of local treatment.

Ultrasonic cavitation. The method of ultrasonic cavitation of wounds is based on the local application of low-frequency ultrasound (20–120 kHz, 0.05–1.0 W / cm^2). This allows to combine its antibacterial effect and the process of mechanical cleaning of the wound.

Treatment of the wound with a pulsating jet. The advantages of this method are the reduction of microbial insemination of the wound surface due to high-frequency pulsation (about 900-1200 pulses per minute). This provides a positive effect, but at the same time doesn't damage the tissue.

Laser irradiation. The use of laser radiation is rational in the first phase of the wound process. During treatment of an infected wound, evaporation of its surface layers occurs. This process leads to the formation of a thin-walled sterile scab.

Negative pressure wound therapy (NPWT). The main goals of vacuum therapy are:

- removal of exudate and reduction of swelling around the wound;
- increasing of microcirculation in soft tissues;
- activation of granulation tissue formation;
- reducing the size and depth of the wound;
- reducing the number of possible complications and the amount of necessary surgical intervention.

The principle of action consists in the application of negative pressure in the area of the wound, under a hermetic bandage, which is connected by a special tube to a container for the accumulation of exudates (pic. 34).

a) b)

Pic. 34. Vacuum therapy: a) vacuum bandages on ulcers of both lower legs; b) a vacuum bandage is connected to a portable device.

Contraindications:

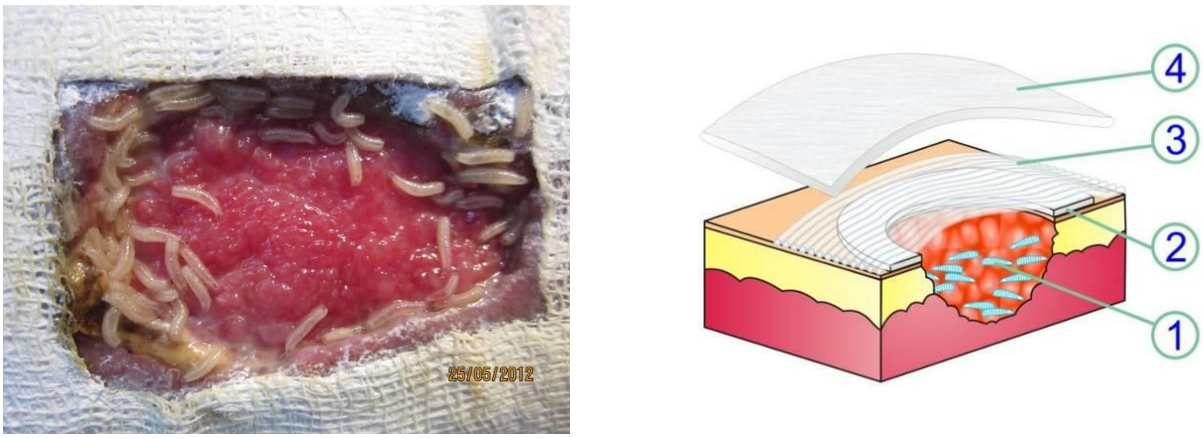
– the presence of a scab in the wound, a large mass of necrotic tissue;

– risk of bleeding (blood coagulation disorders, taking anticoagulants, open large vessels in the wound);

– psychological intolerance of the method.

Maggot debridement therapy (MDT). This is a type of biotherapy with the use of deliberately introduced fly larvae into a human wound, with the aim of selective cleaning of necrotic tissues and promoting its healing.

Larvae of the green flesh fly Lucilia (Phaenicia) sericata are used in the procedure. Larvae are grown in special laboratories, where they are sterilized by using of chemical disinfection. The larvae of this fly species feed exclusively on necrotic tissue and are unable to digest or significantly damage healthy human tissue.



a) b)

Pic. 35 Protection of the surrounding skin with gauze soaked in zinc paste: a) granulation wound of the lower leg with larvae; b) scheme of applying a bandage: (1) larvae in a wound; (2) protective bandage for the skin; (3) chiffon; (4) adsorbent bandage.

Bandage with larvae is applied according to the appropriate method. The larvae are kept in the wounds by applying special bandages to avoid their uncontrolled release (pic. 35). Larvae are applied for 24–48 hours.

Autodermoplasty. Any wound with a diameter of more than 5 cm needs to be closed with a flap or pieces of skin to obtain a stable therapeutic effect and a good functional result. The main condition for performing autodermoplasty is early closure of wound defects with skin flaps, in the absence of prolongation of the purulent-inflammatory process.

a) b)

Pic. 36 Equipment for autodermoplasty: a) flap collection; b) flap perforation.

As a rule, the skin for plastic surgery is taken from the outer surface of the thigh under local or spinal anesthesia. An electric dermatome is used for getting skin flaps, which should be perforated (pic. 36 a, b).

a) b)

c) d)

Pic. 37 Autodermoplasty: a) ulcer before vacuum therapy; b) clean granulating wound after vacuum therapy; c) perforated skin flaps on the wound; d) wound in 2 months after autodermoplasty.

Dermatome flaps allow to cover large wound surfaces – 100 cm^2 or more. Skin grafts with a thickness of 0.3–0.5 mm which are placed on fresh granulations are take root well. The dermatome flap has the same thickness over the entire area and adapts well to the wound surface (pic. 37 a, b, c, d).

QUESTIONS FOR SELF-CONTROL.

1. What are the anatomical and physiological features of the venous system of the lower extremities?
2. What is the etiopathogenesis of the lower extremities varicose veins development?
3. What are the clinical manifestations of the lower extremities varicose veins?
4. Ultrasound examination of the lower extremities veins : indications, method of execution, signs of varicose disease.
5. X-ray contrast phlebography and radionuclide phleboscintigraphy: method of execution.
6. Concervative treatment of varicose veins.
7. Compression therapy for chronic venous insufficiency.
8. Surgical treatment: indications, contraindications, types of surgical interventions, features of the postoperative period.
9. Subfascial endoscopic perforans surgery: indications, contraindications, method of execution.
10. Endovenous treatment: indications, contraindications, types of surgical interventions, features of the postoperative period.
11. Sclerotherapy in the treatment of chronic venous insufficiency.
12. Acute thrombophlebitis.
13. Pathophysiology of venous trophic ulcers.
14. Methods of assessing the condition of venous trophic ulcers.
15. Methods of treatment of venous trophic ulcers.

CONTROL TESTS FOR SELF-CONTROL.

1. Where is Leonardo's vein located?

A. medial surface of the shin;
B. lateral surface of the shin;
C. posterior surface of the shin;
D. medial surface of the hip;
E. lateral surface of the hip.

2. Which venous system include the venous system of the lower extremities?

A. vena cava inferior system;
B. vena cava superior system;

C. portal vein system;
D. venous system of the extremities;
E. small circle of blood circulation.

3. Which veins do not have valves?
A. 56% of perforating veins on the foot;
B. 33% of perforating veins on the hip;
C. 56% of perforating veins on the shin;
D. 15% of deep veins on the hip;
E. 44% of deep veins on the shin.

4. What process is caused by valve insufficiency of superficial varicose veins?
A. vertical reflux;
B. horizontal reflux;
C. endothelial dysfunction;
D. weakness of the muscular layer;
E. all answers are correct.

5. What are the signs of II stage of varicose veins according to CEAP?
A. varicose-veins;
B. reticular veins;
C. no symptoms during the inspection and palpation;
D. swelling;
E. lipodermatosclerosis.

6. What are the signs of III stage of varicose veins according to CEAP?
A. swelling;
B. varicose-veins;
C. reticular veins;
D. no symptoms during the inspection and palpation;
E. lipodermatosclerosis.

7. What is the "gold standard" for the diagnosis of superficial veins?
A. ultrasound;
B. physical examination;

C. Troyanov-Trendelenburg test;
D. X-ray contrast phlebography;
E. radionuclide phleboscintigraphy.

8. What radioactive drug is used for radionuclide phleboscintigraphy?
A. ^{99m} Tc;
B. ^{121m} I;
C. ^{99m} I;
D. ^{109m} Tc;
E. there is no correct answer.

9. Which of the following is a contraindication to compression therapy?
A. peripheral sensory neuropathy;
B. thrombophlebitis;
C. active trophic ulcer;
D. erysipelas;
E. everything that is listed.

10. What is called Linton's operation?
A. a subfascial ligation of perforating veins;
B. a suprafascial ligation of perforating veins;
C. subcutaneous ligation of veins with using of a gauze ball;
D. subcutaneous ligation of veins;
E. removal of varicose branches from small skin incisions.

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