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A clinical case of surgical treatment of complicated chronic venous insufficiency using the principles of hemodynamic management

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Chronic venous disease is a widespread condition that involves telangiectasias, reticular veins, varicose veins, and venous ulcers. In addition to the well-known manifestations and complications, long-term persistent chronic venous insufficiency (CVI) can become a factor that contributes to the development of infectious processes in the skin and subcutaneous fat. If the inflammatory lesion spreads deeper, phlegmon and deep vein thrombosis may occur. 20 % to 50 % of patients suffering from deep vein thrombosis develop post-thrombotic syndrome.

A 59-year-old patient turned to the department of surgery with complaints of severe swelling of the right lower limb, darkening and thickening of the skin, the presence of several wounds from which pus periodically oozed, varicose veins, intermittent pain, and a feeling of distension in the affected limb. A year ago, she was hospitalized with recurrent erysipelas of the right lower limb, which was complicated by phlegmon and required surgery. Over the past year, she had noticed severe swelling of the limb, and the right lower leg had darkened considerably. During ultrasound Doppler mapping, we detected signs of past deep vein thrombosis with partial recanalization at the level of the popliteal vein, incompetence of the saphenofemoral junction, dilation of the great saphenous vein and its tributaries, and incompetence of the perforating veins in the lower third of the leg. The surgical intervention followed the principles of hemodynamic management. After ten and a half months, the patient was fully satisfied with the treatment outcomes. The limb showed no swelling, hyperpigmentation significantly decreased, and the chronic wounds completely healed.

For patients with complicated CVI, a history of inflammatory skin and subcutaneous fat diseases, and an incompetent deep venous system, hemodynamic conservative treatment or CHIVA (Cure Conservatrice et Hemodynamique de l'Insufficience Veineuse en Ambulatoire) is the preferred option. This technique requires a detailed ultrasound Doppler mapping of the venous network and is personalized for each patient. This treatment approach can yield the most stable long-term results, the disappearance of all or most symptoms of CVI, and favourable cosmetic outcomes.

Keywords
varicose disease, chronic venous insufficiency, hemodynamic management, post-thrombotic syndrome.

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Chronic venous disease is a widespread, underdiagnosed condition that involves telangiectasias, reticular veins, varicose veins, and venous ulcers, which can require extensive treatment and hospitalization. The most common manifestation of chronic venous insufficiency (CVI) is varicose veins. Symptoms of CVI also include pain, skin changes, oedema, and ulceration [1]. Venous leg ulcers occur as a complication of CVI and represent the most common type of hard-to-heal wound in the lower extremity. They account for approximately 80 % of all leg ulcers and are commonly located on the medial one-third of the lower leg, anterior to the medial malleolus [1]. In addition to the well-known manifestations and complications, long-term persistent CVI can become a factor that contributes to the development of infectious processes in the skin and subcutaneous fat [6]. Non-necrotizing acute dermo-hypodermal infections are infectious processes that include erysipelas and infectious cellulitis, and are mainly caused by group A β-haemolytic streptococcus. The lower limbs are affected in more than 80 % of cases,

and the risk factors are disruption of the cutaneous barrier, CVI, lymphoedema, and obesity [6, 10]. If the inflammatory lesion spreads deeper, phlegmon and deep vein thrombosis may occur. 20 % to 50 % of patients suffering from deep vein thrombosis develop persistent symptoms of venous system damage, called post-thrombotic syndrome [3, 4].

Today, there are many methods of treating CVI, including conservative drug therapy with venotonics, compression therapy, surgical techniques: stripping and miniphlebectomy, and well-known ablative techniques. Management of CVI requires an individualized approach, so a combination of individual techniques is most often used [1]. Hemodynamic conservative treatment of venous insufficiency in the ambulatory, known as CHIVA (Cure Conservatrice et Hemodynamique de l'Insufficience Veineuse en Ambulatoire), is a good alternative to common procedures. It is associated with less bruising and nerve damage compared to stripping, saphenectomy, or ablation [2]. The main advantages include preservation of the saphenous vein, local anesthesia, low cost, low pain, and fast post-operative recovery. By adhering to all principles, this technique can be combined with various other methods, enabling a personalized approach to each clinical case [2, 5, 7].

Clinical case

A 59-year-old female patient presented to the department of surgery complaining of severe swelling of the right lower limb, darkening and thickening of the skin, the presence of several wounds from which pus periodically oozed, varicose veins, intermittent pain, and a feeling of distension in the affected limb.

According to the anamnesis, two years ago she first suffered from erysipelas of the right leg, was treated conservatively for about 10 days with antibiotic therapy, after which she noted significant improvement. However, the swelling of the limb persisted for a year. After a few months, the patient began to notice a slight darkening of the skin. A year ago, she was hospitalized again with a diagnosis of erysipelas and was prescribed antibiotic therapy, which did not give any results. The infectious process spread deeper, and 11 days after the onset of the disease, phlegmon of the right lower leg was diagnosed, for which surgical intervention was performed. After prolonged postoperative antibiotic therapy (about 3 weeks) and local treatment with the application of dressings, drainage of the wounds with antiseptics, she was discharged from the hospital with improvement. Over the past year, she had noticed severe swelling of the limb, which was present throughout the day, somewhat worsening in the evening. The swelling prevented her from wearing regular clothes and shoes. The right lower leg had darkened considerably over the past year. The patient also reported that varicose veins first appeared more than 30 years ago, after her first pregnancy, but they did not bother her much. Over the past two years, the varicose veins and nodes had increased in size, and there had been a feeling of pain along the veins. The patient sought help at another clinic several months ago, but was denied surgery due to deep vein obstruction. She was prescribed phlebotonics and constant wearing of compression hosiery, which she did not wear due to discomfort.

On examination, the right lower calf was swollen, measuring 4.6 cm larger than the left one in the area of the middle of the lower leg. The skin was indurated with signs of lipodermosclerosis, and hyperpigmentation was present on the anteromedial surface of the lower leg. On the anterior surface of the lower leg along the tibia in the area of postoperative incisions, there were two wounds (fistulas) from which a scanty, whitish, odorless exudate came out. Varicose veins and nodes were outlined on the leg. A particular cluster of varicose nodes was observed on the upper third of the affected lower leg.

Initially, we performed a detailed ultrasound Doppler mapping of the venous system of the patient's lower extremities. The findings revealed the signs of past deep vein thrombosis. Specifically, the sural veins and popliteal vein were partially patent (with signs of partial recanalization), their walls were thickened, and the valve apparatus was not preserved. The femoral vein was patent, and the blood flow was satisfactory. The ostial valve was incompetent. The great saphenous vein was dilated to 16 mm in the middle third of the thigh. Varicose dilated anterior inflow of the great saphenous vein was also visualized. Severe varicose deformation with the formation of conglomerates in nodes was visualized in the posterior peripheral vein. Vertical reflux along the great saphenous vein system was recorded. Dilatation of the perforating veins in the lower third of the leg to 5.5–6.0 mm (Cockett's perforators) with registration of reflux and in the upper third of the leg to 4.2 mm (Boyd's perforators) was detected. During the ultrasound examination, no accumulations of pus were detected in the deep tissues. This patient was also referred for an X-ray and consultation with a traumatologist to ensure that there were no bone lesions.

Given the compromised deep venous system, the selected treatment approach for this patient was hemodynamic management in accordance with the CHIVA principles. We identified a type 1 shunt with a pathological discharge of blood from

the deep venous network through an incompetent saphenofemoral junction (escape point) into the cutaneous venous compartment, a segment of the great saphenous vein itself. Blood from the great saphenous vein returns to the deep venous system through the re-entry perforator (in this case, the main flow returns through Boyd's perforator), thus closing the pathological circle.

The surgical tactics were as follows: we eliminated the saphenofemoral junction, thus removing the escape point; we also performed a crossectomy in the area of the saphenofemoral junction, the great saphenous vein was left intact, and the main flow was drained through Boyd's perforator (re-entry perforator). Using miniphlebectomy, we removed the anterior tributary of the great saphenous vein and the varicosely deformed posterior peripheral vein on the leg. We also eliminated the reflux-compromised perforators of the lower third of the leg – Cockett's perforators. Two days later, the patient was discharged from the surgical ward with recommendations to wear compression hosiery for 6 weeks. Follow-up examinations were scheduled one week after surgery, along with suture removal, and one month after surgery. We evaluated the final treatment outcomes, including a detailed ultrasound Doppler mapping, 10.5 months after surgery.

Treatment outcomes

After ten and a half months, at the follow-up visit, the patient was fully satisfied with the treatment outcomes. Objectively: the limb was not swollen, only 0.5 cm thicker than the left one; hyperpigmentation significantly decreased along the entire length of the lower leg and chronic wounds completely healed. There were no varicose veins or nodes in the lower extremities. The patient reported the disappearance of pain or any discomfort, as well as complete satisfaction with the cosmetic result. During control ultrasound Doppler mapping, we determined a decrease in the diameter of the great saphenous vein to 10 mm in the middle third of the thigh; the draining flow went through the perforators towards the deep system without registering reflux. The results of the treatment are shown in Fig. 1 and Fig. 2.

Figure 1. **Extremity before treatment**

Figure 2. **Extremity 10.5 months after treatment**

Discussion

Inflammatory diseases of the skin and subcutaneous tissue, such as erysipelas and bacterial cellulitis, often occur in patients with CVI [6]. When the inflammatory process spreads to deeper tissues of the limb, lymphangitis, deep vein thrombosis, and phlegmon occur [3, 6]. Past acute deep vein thrombosis leads to persistent changes in the venous system, the so-called post-thrombotic syndrome, which worsens the already existing CVI [8]. Typical signs of post-thrombotic syndrome may include leg edema, redness, dusky cyanosis when the leg is in a dependent position, perimalleolar or more extensive telangiectasiae, new varicose veins, stasis hyperpigmentation, thickening of the skin and subcutaneous tissues of the lower limb known as lipodermatosclerosis, and in severe cases, leg ulcers, which may be precipitated by minor trauma [9, 11]. Post-thrombotic syndrome, in turn, can lead to recurrences of inflammatory diseases of the skin and soft tissues in the extremities, which will work like a vicious circle. For the treatment of post-thrombotic syndrome, compression stockings and medications are more often used than surgical interventions. Venous valve repair, venous bypass, and venous stents may have the potential to decrease post-thrombotic manifestations that are attributable to deep vein obstruction or valvular reflux in patients with post-thrombotic syndrome [6, 9, 11].

For patients with a compromised or completely obstructed deep venous system, hemodynamic conservative treatment of venous insufficiency in the ambulatory (CHIVA) is the preferred approach based on venous hemodynamics with deliberate preservation of the superficial venous system. This technique promotes normalization of distal venous pressure, reduction of the diameter of the venous wall in specific segments, and mitigation or complete disappearance of CVI symptoms [2, 5].

Conclusions

For patients with complicated chronic venous insufficiency, a history of inflammatory skin and subcutaneous fat diseases, and an incompetent deep venous system, hemodynamic management according to the CHIVA principles is the preferred surgical option. This technique can be performed after a detailed ultrasound Doppler mapping of the venous network and is personalized for each patient. This treatment approach can yield the most stable long-term results, the disappearance of all or most symptoms of CVI, and good cosmetic oucomes.

Declaration of interests

The authors have no conflicts of interest to declare.

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Authors contributions

I. V. Kolosovych: work concept and design, critical review, final approval of the manuscript; K.O. Korolova: work concept and design, data collection and analysis, writing the manuscript;

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Клінічний випадок хірургічного лікування із застосуванням принципів гемодинамічної хірургії пацієнтки з ускладненою хронічною венозною недостатністю

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Хронічне захворювання вен, до якого відносять телеангіектазії, ретикулярні вени, варикозне розширення вен і венозні виразки, є поширеним явищем. Окрім загальновідомих виявів та ускладнень, хронічна венозна недостатність (ХВН), що тривало персистує, може стати чинником, що призведе до розвитку інфекційних процесів шкіри та підшкірної жирової клітковини. Якщо запальне ураження поширюється глибше, то можуть виникнути флегмона та тромбоз глибоких вен. Від 20 до 50 % пацієнтів після тромбозу глибоких вен страждають на посттромботичний синдром.

Пацієнтка, 59 років, звернулася до хірургічного відділення зі скаргами на сильний набряк правої нижньої кінцівки, потемніння та потовщення шкіри, наявність кількох ран, з яких виникають періодичні виділення, варикозне розширення вен, періодичний біль і відчуття розпирання в ураженій кінцівці. Рік тому вона була госпіталізована з рецидивом бешихового запалення правої нижньої кінцівки, яке ускладнилося флегмоною, з приводу чого проведено хірургічне втручання. Упродовж останнього року вона відзначала сильний набряк кінцівки, права гомілка значно потемніла. Під час ультразвукового допплерівського картування виявили ознаки перенесеного тромбозу глибоких вен із частковою реканалізацією на рівні підколінної вени, недостатність сафенофеморального співустя, розширення великої підшкірної вени та її приток, а також недостатність перфорантних вен нижньої третини гомілки. Хірургічне втручання проведено відповідно до принципів гемодинамічної хірургії. Через 10,5 міс пацієнтка була повністю задоволена результатом лікування. Кінцівка не набрякала, гіперпігментація значно зменшилася, а хронічні рани повністю загоїлися.

Для пацієнтів зі складною ХВН, запальними захворюваннями шкіри та підшкірної жирової клітковини в анамнезі й недостатністю глибокої венозної системи операцією вибору є гемодинамічна хірургія за принципами CHIVA. Ця методика може бути виконана після детального ультразвукового допплерівського картування венозної мережі. За допомогою персоналізованого підходу до лікування можна досягти максимально стабільного тривалого результату, зникнення всіх або більшості симптомів ХВН, а також доброго косметичного результату.

Ключові слова: варикозна хвороба, хронічна венозна недостатність, гемодинамічна хірургія, посттромботичний синдром.

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