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SONOGRAPHY AND MULTISLICE CONTRAST TOMOGRAPHY IN THE DIAGNOSIS OF CHRONIC VENOUS INSUFFICIENCY COMPLICATED BY TROPHIC ULCERS

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Abstract

Sonography has become the gold standard in the diagnosis of pathological changes in venous insufficiency, however, studies by other scientists indicate the need for a comprehensive study using phlebographic methods.

The aim of the work was to compare the results of sonography and multislice tomography in the diagnosis of chronic venous insufficiency complicated by trophic ulcers.

Materials and methods. The results of treatment of 97 patients with chronic venous insufficiency in stage C6 and C6r were evaluated. Ultrasound angioscanning of the venous system of the lower extremities at the planning stage of surgical treatment and in the postoperative period (early and after a year of observation) was performed on a digital device of expert class for cardiovascular studies (Toshiba Aplio 500) with 5-10 MHz sensor and appropriate standard software package examination of the venous system of the lower extremities. Multislice computed tomography was performed using X-ray computed tomography (Philips Brilliance 64). The study was performed using X-ray contrast iodine-

containing medium (Omnipack-350) at the rate of 1 ml of the drug per kilogram of patient weight.

Research results and their discussion. the sonographic study found that the causes of trophic ulcers were impaired venous blood flow in the veins of the lower extremities due to severe varicose transformation and decompensated reflux, and changes in the deep venous system due to thrombosis of the deep veins.

Greater sensitivity and specificity of multislice computed tomography in the diagnosis of postthrombotic stenoses and obliterations were found compared with sonographic examination. This method is valuable in the study of the anatomy of the venous system, but does not allow to assess the parameters of hemodynamics (duration and degree of reflux, but only its presence).

Key words: chronic venous insufficiency; sonography; multislice contrast tomography

Introduction

Chronic diseases of the veins of the lower extremities are a pathological condition characterized by impaired outflow of venous blood from the lower extremities and manifested by a variety of symptoms and syndromes, including the most obvious varicose transformation and trophic ulcers. By its prevalence and social significance for the population of many countries is one of the most important problems that significantly impair the quality of life and efficiency [4].

From the point of view of pathogenesis all symptoms at chronic venous insufficiency are a consequence of combined action of factors: valvular insufficiency of venous system of lower extremities, retrograde blood flow on hypodermic veins, and subsequently deep that leads to formation of pathological horizontal and vertical venous-venous refluxes, development of trophic ulcers [5].

The most pronounced phlebohemodynamic processes are observed in the lower third of the medial surface of the tibia, although there are hemodynamically significant refluxes at other levels of the limb [7]. In this area there is a significant retrograde blood flow, which occurs due to valvular insufficiency of the superficial and perforating veins of the leg of the Coquette group. No less important mechanism for the development of venous hypertension is a violation of the function of the "muscular-venous pump" of the lower extremities, which in varicose veins is most pronounced in the vertical position.

Of course, sonography has become the gold standard in the diagnosis of pathological changes in venous insufficiency, however, studies by other scientists indicate the need for a comprehensive study using phlebographic methods [1, 2].

The aim of the work was to compare the results of sonography and multislice tomography in the diagnosis of chronic venous insufficiency complicated by trophic ulcers.

Materials and methods

The results of treatment of 97 patients with chronic venous insufficiency in stage C6 and C6r were evaluated, which were divided into two clinical groups: retrospective (n=50) in which classical surgical treatment was performed (Coquette veins ligation, Narat phlebectomy) and prospective (n=47) in which classical surgical intervention (crossectomy + Bebcock and / or Narat phlebectomy) was used in combination with the developed method of treatment of trophic wounds [6]. Both groups were representative by age, sex, study and comorbidities, risk factors, features of medical history, as well as conditions of surgical treatment (surgical treatment was performed in one hospital).

Ultrasound angioscanning of the venous system of the lower extremities at the planning stage of surgical treatment and in the postoperative period (early and after a year of observation) was performed on a digital device of expert class for cardiovascular studies (Toshiba Aplio 500) with 5-10 MHz sensor and appropriate standard software package examination of the venous system of the lower extremities.

To study the features of pathological changes of the venous system of the lower extremities in patients in the preoperative period, multislice computed tomography was performed using X-ray computed tomography (Philips Brilliance 64). The study was performed using X-ray contrast iodine-containing medium (Omnipack-350) at the rate of 1 ml of the drug per kilogram of patient weight.

Research results discussion

According to the results of sonography (great saphenous vein, femoral vein, popliteal vein) in patients of both groups there was mainly uneven thickening of their walls, with expanded average diameters, reduced contractility, reduced rigidity when compressed by an ultrasonic sensor. In places, the walls of the veins, both superficial and deep, were significantly thickened with peri-wall hyperechogenic inclusions. The valvular apparatus was poorly functioning, with manifestations of insufficiency, which was registered in the form of hemodynamically significant vertical and horizontal refluxes. Doppler examination of the vessels of the lower extremities revealed that 55.32% of patients in the prospective and 62.0%

of the retrospective group with varicose veins had a failure of the valves of the femoral and popliteal veins.

The combination of failure of the valvular apparatus of the subcutaneous veins and deep veins was diagnosed in 76.0%, subcutaneous and perforating veins - in 40.0%, deep and perforating veins - in 84.0%, superficial. In 56.7% of cases of both groups, pathological retrograde blood flow through deep veins corresponded to III - IV degree of hemodynamic significance (according to R.L. Kistner) [3].

In the stage of decompensation, significant hemodynamic disorders of venous outflow from the lower extremities were observed. Diagnosis of a decrease in linear velocities and volumetric blood flow through the superficial and deep venous system, as well as a compensatory increase in the volume of outflow through the system of muscular and subcutaneous collaterals. Indicators of peripheral hemodynamics in patients with class C6 are presented in table 1.

Table 1 - Quantitative indicators of peripheral hemodynamics in patients of both groups with chronic venous insufficiency class C6 (CEAP)

vessel	V_{max} (см/sec)	S ($см^2$)	V_{cp} (см/sec)	V_{ob} (ml/min.)	V_{ob} (%)
Retrospective group (n = 50)					
Femoral vein	5.2±1.8	0.45±0.06	3.9±2.01	161.1±0.75	24.67
Deep femoral vein	6.2±1.5	0.41±0.07	3.8±1.7	92.7±1.12	13.87
Great subcutaneous vein	9.7±1.9	0.46±0.12	8.1±1.09	85.5±1.08	14.89
Collateral veins	-	-	-	330.08±2.65	49.87
Prospective group (n = 47)					
Femoral vein	5.0±1.7	0.41±0.08	3.7±1.99	159.3±0.74	23.45
Deep femoral vein	6.1±1.4	0.39±0.06	3.9±1.5	94.6±1.02	14.23
Great subcutaneous vein	10.3±1.8	0.44±0.11	7.8±1.06	87.2±1,06	14.13
Collateral veins	-	-	-	327.15±2.47	48.65

In chronic venous insufficiency of clinical class C6, hemodynamics significantly deteriorated, both in the deep and superficial venous system by reducing the volume of blood transport. The load on the system of muscular and subcutaneous collaterals in the retrospective and prospective groups increased by 49.87% and 48.65%, respectively.

In postthrombophlebitic disease of the lower extremities in the stage of recanalization significantly deteriorated hemodynamics, both in the deep and in the superficial venous system of the lower extremities. The volume of blood transportation by them significantly decreased. The role of ERW, which diverts up to 20% of venous blood, increased. The main

role in the outflow of venous blood from the affected lower extremities at this stage accounted for the system of muscular and subcutaneous collaterals, more than 55-60% of the blood. (tabl. 2).

Table 2 - Ultrasound changes of postthrombophlebitic disease in patients of both groups.

Ultrasound signs	**Retrospective group (n = 50)**	**Prospective group (n = 47)**
Postthrombotic stenosis	1.50 %	2.12 %
Areas of recanalization	0.24 %	31.91 %
Failure of deep vein valves	62.0 %	55.32 %
Thickening of the walls of deep veins	58.0 %	53.19 %

Of the 17 patients in the prospective group, 10 (58.82%) underwent multislice computed tomography to clarify the location of pathological changes due to deep vein thrombosis of the lower extremities.

There was no case of fresh thrombotic layers in either the deep or superficial venous system. Old thrombotic masses partially blocked the lumen of the vein (up to 1/3 of the lumen), which was characteristic of the stage of recanalization.

According to the results of the study were found: arterio-venous fistulas - 20.0%, partial obliteration of the external iliac vein (recanalization) - 20.0% partial obliteration of the common femoral vein (recanalization) - 20.0% (Fig. 1), partial obliteration of the popliteal veins (recanalization) - 50.0%, partial stenosis of the femoral vein - 10.0%, partial stenosis of the popliteal vein - 30.0%, failure of perforating veins 100.0% of cases (Fig. 2).

In all cases, failure of the valves of the deep venous system with a pronounced retrograde flow of contrast medium through the femoral valves was diagnosed. In addition, the data of sonography on the pronounced dilatation of venous structures were confirmed.

Due to severe valvular insufficiency, weakness of the musculo-venous pump and disturbances in venous hemodynamics in all 10 patients was visualized overflow not only of the main venous bed of the lower extremity, but also collateral veins, sural sinuses, which caused clinically pronounced lymphatic venous edema.

Comparison of the results of sonographic and phlebographic studies are presented in table 3.

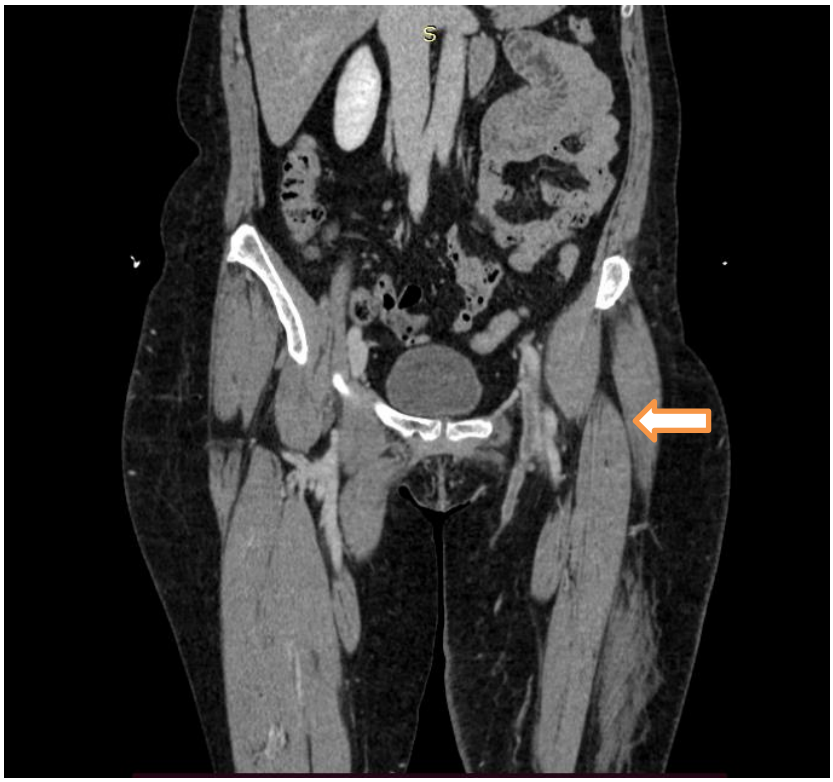

Figure 1 - Partial obliteration of the common femoral vein due to left ileofemoral thrombosis

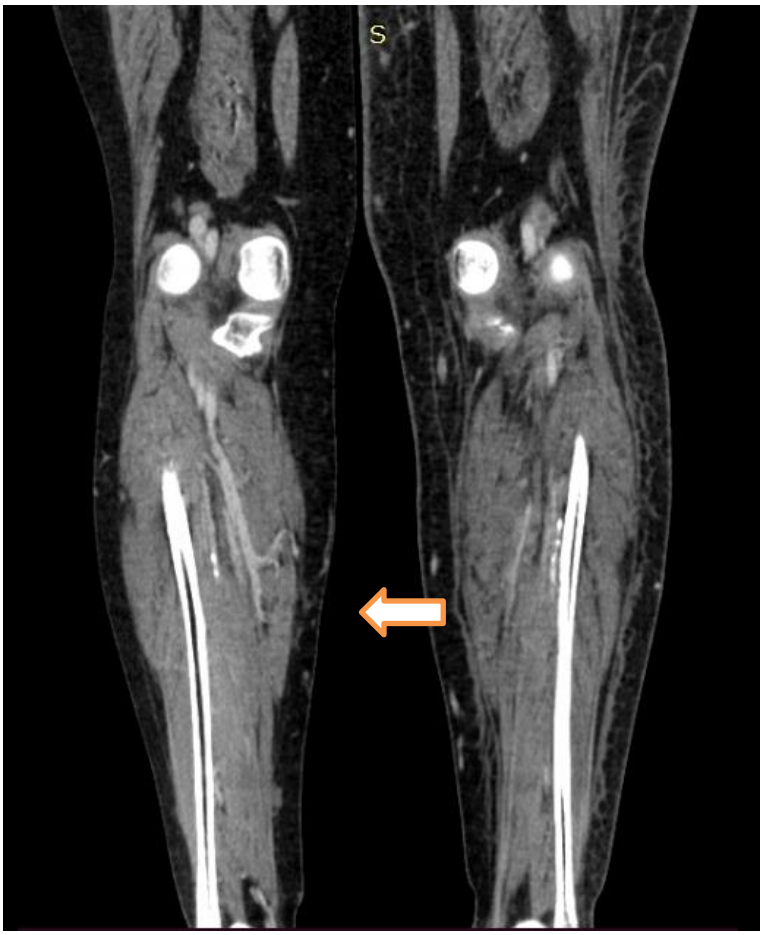

Figure 2 - Failure of the perforating veins

Table 3 - Comparison of the results of instrumental research methods in the diagnosis of chronic venous insufficiency (n = 10)

Characteristics and localization of pathological changes	Sonography	CT phlebography
Arterio-venous fistulas	-	2 (20 %)
Partial obliteration of the common iliac vein (recanalization stage)	-	2 (20 %)
Partial obliteration of the common femoral vein (recanalization stage)	1 (10 %)	3 (30 %)
Partial obliteration of the popliteal vein (recanalization stage)	3 (30 %)	5 (50 %)
Partial stenosis of the common femoral vein	-	1 (10 %)
Partial stenosis of the popliteal vein	1 (10 %)	3 (30 %)
Failure of perforating veins	10 (100 %)	10 (100 %)

Conclusions: Thus, the sonographic study found that the causes of trophic ulcers were impaired venous blood flow in the veins of the lower extremities due to severe varicose transformation and decompensated reflux, and changes in the deep venous system due to thrombosis of the deep veins.

Greater sensitivity and specificity of multislice computed tomography in the diagnosis of postthrombotic stenoses and obliterations were found compared with sonographic examination. This method is valuable in the study of the anatomy of the venous system, but does not allow to assess the parameters of hemodynamics (duration and degree of reflux, but only its presence).

References

1. Arnoldussen, C. W. K. P., De Graaf, R., Wittens, C. H. A., & De Haan, M. W. (2013). Value of magnetic resonance venography and computed tomographic venography in lower extremity chronic venous disease. Phlebology, 28(1_suppl), 169-175. DOI: 10.1177/0268355513477785

2. Ashour, M. F., Abd El Rahman, M. A., Kamel, A. N., Eldin, S. M. E., SaadEldin, A. M., & Zaki, M. M. M. (2021). Comparative study between the use of intravascular ultrasound versus conventional venography in management of iliofemoral chronic venous insufficiency. The Egyptian Journal of Surgery, 40(1), 140.

3. Lurie, F., Kistner, R. L., Eklof, B., & Kessler, D. (2003). Mechanism of venous valve closure and role of the valve in circulation: a new concept. *Journal of vascular surgery*, *38*(5), 955-961. DOI: 10.1016/s0741-5214(03)00711-0

4. Prochaska, J. H., Arnold, N., Falcke, A., Kopp, S., Schulz, A., Buch, G., ... & Wild, P. S. (2021). Chronic venous insufficiency, cardiovascular disease, and mortality: a population study. European Heart Journal, 42(40), 4157-4165. DOI: 10.1093/eurheartj/ehab495

5. Santler, B., & Goerge, T. (2017). Chronic venous insufficiency–a review of pathophysiology, diagnosis, and treatment. JDDG: Journal der Deutschen Dermatologischen Gesellschaft, 15(5), 538-556. DOI: 10.1111/ddg.13242

6. Suxodolya AI, Suxodolya SA, Kolomiyecz OV , Krelov K. Yu. Sposib likuvannya trofichnyx vyrazok pry xronichnij venoznij insufficiency. (2018). A61B 17/00, A61M 25/01 (2006.01), A61K 31/167 (2006.01), A61P 17/02 (2006.01). Patent for utility model № 117797. byul. № 18/2018.

7. Zygmunt, J. A. (2014). Duplex ultrasound for chronic venous insufficiency. J Invasive Cardiol, 26(11), E149-155.