

PHLEBOGRAPHY IN ASSESSING CHRONIC VENOUS INSUFFICIENCY

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Abstract: Chronic venous insufficiency (CVI) (van der Molen) (1) is a clinical syndrome with different etiopathogeny, prognosis and therapeutics that is subsequent to chronic disturbances of venous circulation, especially in the lower limbs, resulting in significant changes of the interstitial space, lymphatics and skin. Chronic venous insufficiency includes two subdivisions clinically similar, but different in terms of etiopathogenesis, therapeutics and prognosis: superficially CVI, representing the late stage of the varicose disease and of the chronic deep venous insufficiency and the postphlebotic syndrome. This article aims at analysing the relevant epidemiological factors in determining the varicose disease and the deep vein thrombosis (endogenous factors: anthropological, anatomical and physiological, genetic, constitutional, sex, age, endocrine factors, pregnancy, obesity, health status and exogenous factors: physical and social, the morphological analysis of the static and dynamic aspects of ultrasound, colour and spectral Doppler in the varicose disease, deep venous thrombosis (DVT) and post thrombotic syndrome, compared with phlebography; establishing the role of the two radio-imaging methods in the diagnosis of chronic venous insufficiency.

Cuvinte cheie: insuficiența venoasă cronică, ecografie, flebografie

Rezumat: Insuficiența venoasă cronică (van der Molen) (1) este un sindrom clinic cu etiopatogenie, prognostic și terapeutică deosebite, ce se constituie tardiv, ca urmare a unor tulburări cronice ale circulației venoase, în special la nivelul membrelor inferioare, ce antrenează modificări importante ale interstițiului, limfaticelor și pielii. Insuficiența venoasă cronică include două subdiviziuni clinic aproape similare, dar deosebite din punct de vedere al etiopatogeniei, terapeticii și prognosticului: insuficiența venoasă cronică suprafascială, stadiul tardiv al insuficienței venelor superficiale și al varicelor și IVC subfascială reprezentată de sindromul posttrombotic. Acest material este elaborat pe baza tezei de doctorat a Dr. Ciprian Șofariu ce și-a propus: analiza unor factori epidemiologici relevanți în declanșarea bolii varicoase și a trombozei venoase profunde (endogeni: antropologici, anatomo-fiziologici, genetici, constituționali, sex, vârstă, endocrini, sarcină, obezitate, stare de sănătate și exogeni: fizici și sociali); analiza aspectelor ecografice morfologice statice și dinamice, Doppler color și spectral în boala varicoasă, TVP și sindromul posttrombotic, comparativ cu cele flebografice; stabilirea rolului celor două metode radio-imagistice în diagnosticul IVC.

INTRODUCTION

Chronic venous insufficiency (CVI) (van der Molen) (1) is a clinical syndrome with different etiopathogeny, prognosis and therapeutics that is subsequent to chronic disturbances of venous circulation, especially in the lower limbs, resulting in significant changes of the interstitial space, lymphatics and skin.

PURPOSE

This article aims at analysing the relevant epidemiological factors in determining the varicose disease and the deep vein thrombosis (endogenous factors: anthropological, anatomical and physiological, genetic, constitutional, sex, age, endocrine factors, pregnancy, obesity, health status and exogenous factors: physical and social, the morphological analysis of the static and dynamic aspects of ultrasound, colour and spectral Doppler in the varicose disease, deep venous thrombosis (DVT) and post thrombotic syndrome, compared with phlebography; establishing the role of the two radio-imaging methods in the diagnosis of chronic venous

insufficiency.

METHODS

Patients' selection: people who presented for ultrasound and phlebography investigations in the Radiology Department of the Children's Hospital of Sibiu, Radiology and Medical Imaging Department of the Emergency Clinical County Hospital of Sibiu, "Body and soul-Prof. Dr. Ilie Craciun "Clinic, "Medica Nursing Plus" Clinic with a clinical diagnosis of varicose veins, deep vein thrombosis and post thrombotic syndrome.

Diagnostic methods used:

For analysis, we used groups of patients (432 patients only with ultrasound examination, 54 patients only with phlebography examination and 87 patients with ultrasound examination followed by phlebography, 10 witness patients for ultrasound examinations, and 3 for phlebography).

RESULTS AND DISCUSSIONS

Reasons for the existence of relevant epidemiological

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factors in causing varicose veins and deep vein thrombosis: endogenous factors: anthropological, anatomical and physiological, genetic, constitutional, sex, age, endocrine factors, pregnancy, obesity, health status and exogenous factors: physical and social.

It may be noted that most of the patients suffering with venous system diseases are grouped around the decades: five, six and seven of life with a peak between 51 and 60 years old.

The incidence of varicose veins in the studied groups was of 71%, of which 46% women and 25% male, with a ratio of about 2:1 in favour of females), similar to the Chiesa's multicenter study, most of them coming from the urban areas.

Regarding the pathogenesis of the varicose veins, venous walls meiotopia has a genetically influence proven by the high percentage of patients with a family history of hydrostatic varicose veins among the relatives of first degree.

Among the patients with a family history of varicose disease, 37% of them said they inherited the disease from both parents. Note that disease transmission to offspring has a high percentage in the group of patients with varicose disease, so 47% of them have children with clinical manifestations in various stages: from spider veins to varicose veins with edema and trophic skin changes.

Pregnancy plays an important part in varicose veins or on their accentuation in the susceptible women, 54% of the patients considering pregnancy as a trigger point. The higher incidence of varicose veins in multiparous women compared with nuliparous: ratio 3:1 and the tendency to balance the ratio - men:women after menopause, indicates the involvement of female hormones in the genesis of the varicose veins. Părvu and Gherasim (2,3) consider that large amounts of estrogen secretion induce connective tissue laxity and increased venous walls distensibility. Oral contraceptives cause endodermic varicose veins. The endocrine status during pregnancy may lead to the opening of arterial-venous fistula responsible for venous congestion. Hypervolaemia of pregnancy and impairing blood flow in leg veins due to large abdominal vein compression by gravid uterus and increased blood flow in the ovarian veins are factors that cause lower limb venous distension. The hypothesis of primary varicose veins of the legs genesis, through arterial venous shunts is based on the finding of increased oxygen saturation and a higher temperature in blood from the varicose segments than in that of non varicose veins or in mixed venous blood.

Profession remains the only adjuvant in the context of genetic predisposition existence. There are patients with varicose disease who do not subscribe to the panoply prone professions. However, even in the susceptible professions, most of the patients do not develop the disease. Professional predisposing factor is a prerequisite but insufficient as to trigger the disease. On the other hand, short exercises during the working hours that make the muscle pump function or positions that favour the venous channels reduce the risk for developing varicose veins even in the case of susceptible professions. Inactivity and obesity are reflected in the development of varicose veins in the susceptible people, because any mechanical heaviness of the blood flow in both veins and in the deep subcutaneous veins (ascites, pregnancy, abdominal tumours, various compression, thrombosis) lead to the production of varicose veins by increasing the intra abdominal pressure.

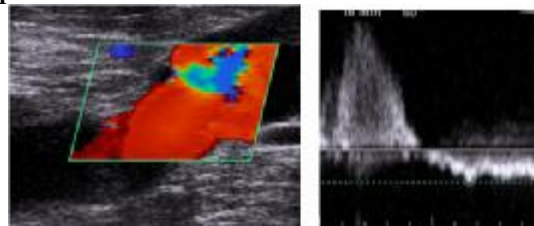
Most of the patients in the study group were included in class 2 (varicose veins). A significant percentage of patients have come for imaging evaluation in view of an appropriate therapeutic approach.

The saphenous ostium valve reflux can be caused by functional valves insufficiency in the context of increasing the

size of SFJ with incomplete closure of the valve (most of the cases) or by congenital or acquired defects of valves cusps. The reflux can be modulated, respiratory and / or by arterial pulse.

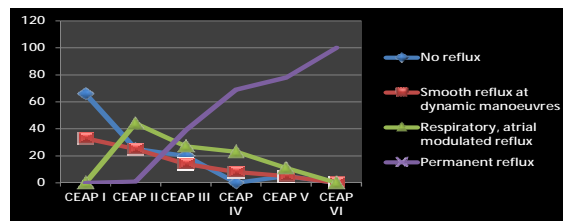
Depending on the flow, it may vary from fine reflux induced by the dynamic manoeuvres up to massive reflux with a maximum peak at the manoeuvres inducing the increase of the intra abdominal pressure.

Figure no. 1. Complete reversal of flow direction (massive reflux), respiratorily modulated with a defect of the anterior cusps of the SFJ valve seen in colour flow



The illustration of massive reflux in duplex Doppler: two-dimensional view reveals a slow flow with hematic macro aggregates, "smoke flow", which is reversed at some point becoming turbid. Spectral Doppler image illustrates high amplitude positive waves (flow speed of about 40 cm / sec, corresponding to the respiratory modulation)

Figure no. 2. Correlation between the level of ostial reflux disease and the severity of the disease illustrated by CEAP classification



Perforating veins play an important part in the hemodynamic status of the lower limbs, being a system of "locks" with two valves, ensuring an unidirectional flow, facilitated by muscle pump, from the surface low pressure system to the deep high pressure system. Perforating veins on phlebography stands out much easier than on ultrasound, where the device performance, time for examination, versatility can influence their detection. Perforating veins are easier to quantify on phlebography, while the sense of flow, its velocity or the insufficient valves are easy to quantify on ultrasound examination.

Figure no. 3. Complete reversal of the sense of flow in colour and spectral Doppler



In the group of patients with varicose disease, 10.47% of them had changes of acute thrombophlebitis (variable echogenic image associated with Celsian phenomena), while only 7% had variable echogenic images without acute inflammatory phenomena-old thrombophlebitis.

The patients with DVT represent approximately 10% of those with venous disease, with an uneven distribution between genders: 35% men and 65% women.

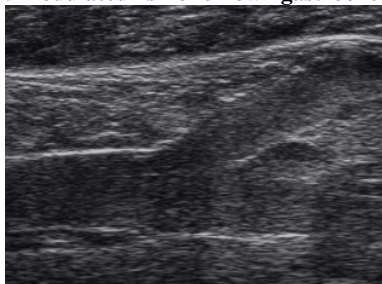
Lower limb deep vein thrombosis can be triggered by any component of Virchow triad: venous stasis, parietal lesion, blood hypercoagulability.

One of the signs regarding the installation of venous stasis is the presence of valvular reflux in the deep vein valves, initially by functional valvular insufficiency due to increasing size (central reversed of the flow direction in colour flow and positive wave in spectral Doppler), and respiratory modulated changes.

Figure no. 4. Common femoral vein reflux



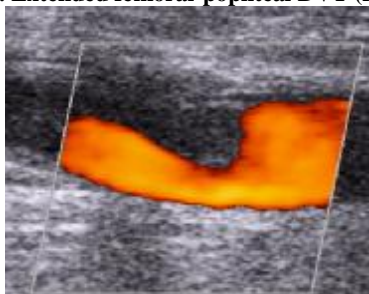
Figure no. 5. Modulated “smoke flow” gastrocnemius vein



Bi-dimensional ultrasound highlights the following changes: thrombus presence into vessels as a hypoechoic – or anechoic image with thin echogenic rim, positive vessel compression test, significant increase in calibre of the thrombosed vessel, immobility of venous valves in an intermediate position, “smoke flow”, changes in the soft tissues.

Spectral Doppler examination reveals the spontaneous or induced absence of Doppler waves in the thrombosed vessel, or its changes.

Figure no. 6. Extended femoral-popliteal DVT (femoral vein)



Colour flow Doppler highlights: colour gaps, assessment of the degree of obstruction on axial sections, assessment of cranial limit of thrombus on longitudinal sections, complete or partial absence of the lumen filled with colour.

viewed on perpendicular sections spontaneously and after dynamic manoeuvres.

Figure no. 7. DVT gastrocnemian vein



Figure no. 8. DVT highly incomplete sinus opacification



Figure no. 9. Sinus thrombus



Phlebography findings: absence or partial opacities of vascular lumens/removed, irregular wall contour, hemodynamic response of the superficial system, enlargement of the perforating veins.

POST-THROMBOTIC SYNDROME

Figure no. 10. Fine repermeabilisation channel at FV middle part of the Hunter channel

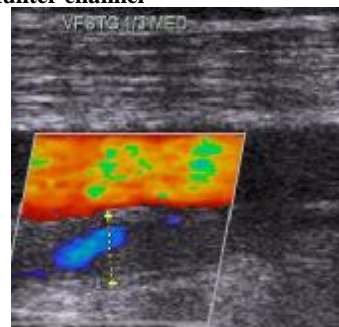
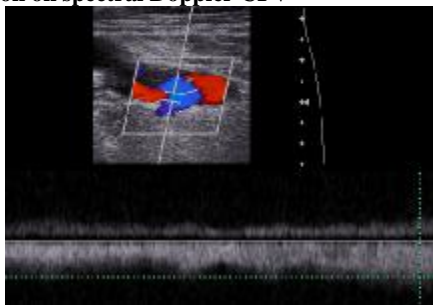


Figure no. 11. “Running channel Leakage channel” aliasing, colour filling defect, absence of respiratory and cardiac modulation on spectral Doppler CFV



According to Douzat, quoted by Dudea and collaborators, ultrasound post-thrombotic syndrome aims at highlighting four vascular syndromes in varying degrees: venous obstruction syndrome, restrictive syndrome, repermeabilisation syndrome, alternate syndrome, hemodynamic and morphological changes of the superficial venous system (high flow velocities, continuous flow, without modulation).

Figure no. 12. CT appearance of sinuous channel of repermeabilisation of right femoral vein in the Hunter channel, sinuous, accompanying veins. Varicose of great saphenous vein

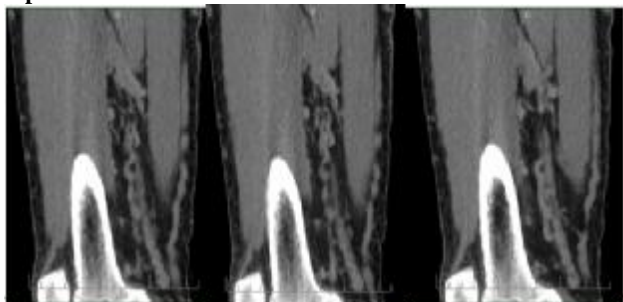
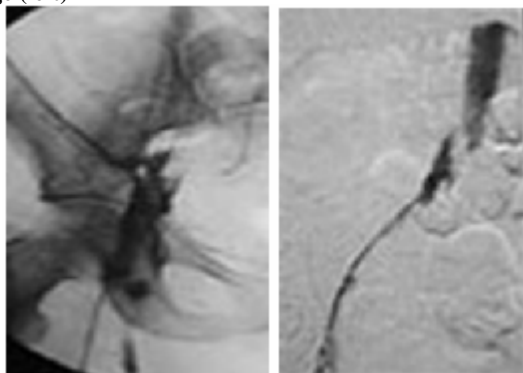


Figure no. 13. Viewing the iliac axis. Post-thrombotic syndrome iliac shaft with fine repermeabilization channel, comparative aspect between phlebography with the classic image (right) and phlebography with digital subtraction image (left)



CONCLUSIONS

Ultrasound is the imaging method of first choice in exploring the peripheral venous system due to accessibility, repeatability, noninvasive nature, lack of contraindications and side effects.

By exploring the limits of ultrasound, we can mention the fact that ultrasound is a laborious, subjective, operator dependent, time-consuming method which is closely linked with the device performance. Another drawback is the unsatisfactory

exploring of deeper or overlapping gaseous structures (confluence of common iliac vein, distal segment of the inferior vena cava).

Post-thrombotic syndrome and varicose disease were the most numerous indications for phlebography, there are also cases where the confounding clinical signs between the two entities make arbitrary its inclusion into one or other class of disease, because many of varicose disease had post-thrombotic syndromes, or post-thrombotic syndrome developed secondary varicose disease on superficially venous system.

Phlebography examination is highly sensitive (ca. 28%) in detecting the characteristic changes of postthrombotic syndrome (parietal irregularities, filling gaps, absence of opacification of the vascular lumen) occurred with the smaller vessels of the lower leg (both intramuscular lakes and venous axes of calf: posterior tibial and peroneal veins).

Phlebography represents a map of the venous system easily to examine, to be viewed, and displayed in a treatment room or operating theatre, more accessible for the physician than a bushy, descriptive, but more complex documentation whose hemodynamic and mechanical information allows coherent treatment strategies.

Among the limits of phlebography exploration, we may mention the fact that it requires a minimum invasive manoeuvre, usually performed on an edema member, the administration of iodinated contrast substance, with its risks (anaphylaxis shock, vasovagal reactions, renal dysfunction in the patients predisposed to chronic renal failure).

It is said that phlebography is the gold standard for the venous system examination. It is difficult to appreciate which imaging methods deserve this title because if digital subtraction phlebography gives details of the morphological changes and partly related to hemodynamics, ultrasonography is sufficient in most cases for the evaluation, before and after therapy, of the venous system, giving superior hemodynamic data to any radio-imaging methods.

REFERENCES

1. Opie JC, Sos PJ, Izdebski Th, Shacket R, Alpern J, Umer A. An Autogenous Solution for Chronic Venous Insufficiency, *Vascular Disease Management*. 2011;7:204-209.
2. Gherasim L, Pârnu V. Bolile venelor periferice, venelor cave și vaselor limfatice ale membrilor, în *Tratat de medicină internă sub redacția Păun R*, Editura Medicală: București. 1994;4:174.
3. Ivan V. Clasificări în patologia venoasă a membrilor inferioare, *Revista română de flebologie*. 2003;1:46-49.
4. Badea RI, Dudea SM, Mircea AP. și colab. *Tratat de ultrasonografie clinica*, Ed. Medicala: Bucuresti; 2006. p. 1-3.
5. Brînzeu P, Gavrilăscu Șt. *Angiografia în practica medicală*, Ed. Facla; 1977. p. 185 – 225.