



UPDATE IN RADIOLOGY

Doppler ultrasound study and venous mapping in chronic venous insufficiency[☆]



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Abstract Chronic venous insufficiency of the lower limbs is very prevalent.

In recent decades, Doppler ultrasound has become the method of choice to study this condition, and it is considered essential when surgery is indicated.

This article aims to establish a method for the examination, including venous mapping and preoperative marking. To this end, we review the venous anatomy of the lower limbs and the pathophysiology of chronic venous insufficiency and explain the basic hemodynamic concepts and the terminology required to elaborate a radiological report that will enable appropriate treatment planning and communication with other specialists.

We briefly explain the CHIVA (the acronym for the French term “cure conservatrice et hémodynamique de l’insuffisance veineuse en ambulatoire” = conservative hemodynamic treatment for chronic venous insufficiency) strategy, a minimally invasive surgical strategy that aims to restore correct venous hemodynamics without resecting the saphenous vein.

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PALABRAS CLAVE

Varices;
Insuficiencia venosa;
Ecografía Doppler;
CHIVA;
Cartografía venosa;
Shunt venovenoso

Estudio de la insuficiencia venosa crónica mediante ecografía Doppler y realización de cartografía venosa

Resumen La insuficiencia venosa crónica (IVC) de las extremidades inferiores es una enfermedad muy prevalente.

La ecografía Doppler se ha establecido en las últimas décadas como el método de elección en el estudio de esta patología, por lo que resulta imprescindible ante una eventual indicación quirúrgica.

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El objetivo de este trabajo es establecer una metodología en la exploración, incluyendo la realización de cartografía y el marcaje prequirúrgico. Para ello revisaremos la anatomía venosa de los miembros inferiores y la fisiopatología de la IVC explicando los conceptos hemodinámicos básicos y la terminología necesarios para la realización de un informe radiológico que permita una adecuada planificación terapéutica y comunicación con otros especialistas.

Explicaremos brevemente la estrategia CHIVA (cura hemodinámica de la insuficiencia venosa ambulatoria), método quirúrgico mínimamente invasivo que tiene como objetivo restaurar la hemodinámica venosa sin extirpar la vena safena.

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Introduction

Chronic venous insufficiency (CVI) is the set of symptoms and signs derived from venous hypertension in the lower extremities due to poor valvular function of the venous systems.^{1,2}

CVI is the most frequent vascular disease; it affects 20–30% of the adult population and 50% of people over 50 years of age, with a prevalence in Spain of 48.5% of men and 58.5% of women.³

It is suffered in different degrees of seriousness, and it is a problem of public health with significant socio-economic and labor implications. It is the cause for 2.5% of medical leaves in some of our neighboring countries and overall it consumes up 2% of the public health budget.⁴

Every venous insufficiency is the consequence of a valvulation, which results primarily (essential varicose veins) from the affection of the superficial venous system and perforator veins, or secondarily (post-phlebotic or post-thrombotic) due to valvular destruction occurring in the deep venous system as a consequence of post-thrombotic recanalization.⁵

The clinical manifestations of CVI include a wide range of manifestations from initial symptoms such as heaviness, pain or edema; varicose disease, when the varicose veins become visible, above all with orthostatism, to late symptoms, with changes in skin coloration and trophic disorders that can trigger complications (varicophlebitis, varicorrhage, increase in the cicatrization time of leg wounds, dermatitis and trophic ulcers).⁶

Doppler ultrasound is the only non-invasive procedure capable of providing an anatomic and hemodynamic topography for venous circulation of the lower extremities in real time, therefore it is the diagnostic method of choice.

Ever since the appearance of Doppler ultrasound, and progressively, phlebography has come into disuse, since it is an invasive procedure, which uses IV contrast and ionizing radiations, and it has complications associated.

The systematic use of phlebography with CT and phlebography with MRI is not justified today in the study of CVI, and their indications are restricted to a select group of patients, especially: cases of venous insufficiency of unusual cause that manifest themselves in a complex manner, one that is not cleared up by Doppler examination: varicose veins of pelvic or abdominal origin, unusual anatomic variants or vascular malformations, and recurrent varicose veins of unclear etiology.^{1,7–9} An adequate ultrasound study,

including mapping and pre-surgical marking, is essential for the surgeon to plan treatment and it has allowed us to lay the foundations of conservative treatment of CVI.¹⁰

The CHIVA method is a minimally invasive surgical technique for the treatment of varicose veins. The goal of this surgery is to eliminate veno-venous derivations through disconnection of the escape points, preserving the saphenous vein and normal venous drainage of the superficial tissues of the limb. To obtain optimal results, it is necessary for the valvulo-muscular pump to work properly and to guarantee the integrity of the deep venous system.

Other therapeutic possibilities in the treatment of varicose veins are stripping (classical surgical treatment with ligation of the arch and saphenectomy), sclerotherapy and endovascular therapy (radiofrequency or endolaser).

Regardless of the surgical technique used, the initial Doppler study is necessary to establish therapeutic indication, know the origin of the varicose collaterals and what the hemodynamic pattern causing them is. When we use the CHIVA technique, immediate pre-operative marking is essential.

The goal of this article is to establish a methodology in Doppler ultrasound study in CVI and venous mapping and pre-surgical marking.

Anatomy

There are two venous fasciae, both hyperecogenic and easily identifiable: the muscular or deep fascia, covering the muscular planes, and the superficial or venous fascia outlining the subcutaneous cellular tissue.^{11,12} This allows us to delimit venous networks (Fig. 1):

- *N1 or primary network*: deep with respect to the muscular fascia. This is where the deep venous system (DVS) lies which runs parallel to the arteries from the foot to the thigh. It is made up of plantar veins, the tibial veins, the popliteal vein and the femoral vein. The sinusoids located within the muscle at calf level are the soleus and the gastrocnemius veins are important too.
- *N2 or secondary network*: between both fasciae (sign of the eye) (Fig. 2). The superficial venous system is located here and it is made up of the internal saphenous vein (ISV), the external saphenous vein (ESV), and their anatomical variants (anterior saphenous and Giacomini veins) (Fig. 3A).

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