



ASSOCIATION BETWEEN INSUFFICIENT VENOUS SYSTEMS AND CLINICAL MANIFESTATIONS IN CHRONIC VENOUS DISEASE OF THE LOWER LIMBS

ASOCIACIÓN ENTRE SISTEMAS VENOSOS INSUFICIENTES Y MANIFESTACIONES CLÍNICAS EN ENFERMEDAD VENOSA CRÓNICA DE MIEMBROS INFERIORES

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ORIGINAL PAPER

ABSTRACT

Introduction: The clinical, etiological, anatomical and pathophysiological classification (CEAP) standardizes the manifestations of lower limb venous disease. **Objective:** To investigate the association between insufficient venous systems and the clinical classification of CEAP. **Methods:** A quantitative, cross-sectional, analytical, correlational design was carried out. Non-probability sampling for convenience. Sample size was 136 lower limbs from 71 patients. Chi-square, Monte Carlo and Odd ratio (OR) statistical tests were used with 95% confidence intervals through bivariate logistic regression ($p < 0.05$). **Results:** 71.8% were female, average age of 66.1. The most frequent insufficient venous system was the superficial one (61.7%). 100% of the dilated great saphenous veins (GSV) had insufficiency. The most frequent CEAP clinical class was C2: 44.9%; 35.1% of C1 (telangiectasia) had an insufficient venous system and 50% of C2 had GSV insufficiency ($p = 0.227$). There was an association between insufficiency of the superficial and deep venous systems and the CEAP clinical classification ($p < 0.001$). The deep venous system was associated with severe chronic venous disease of the lower limbs OR (6.04) with 95% CI (1.02-35.73) and $p = 0.047$. **Conclusions:** An association was evident between the insufficiency of the superficial and deep venous systems with the clinical classification of CEAP. One third of lower limbs with C1 (telangiectasias) had an insufficient venous system.

Keywords: Varicose veins; Doppler ultrasonography; Lower limbs; Veins. (Source: MESH-NLM)

RESUMEN

Introducción: La clasificación clínica, etiológica, anatómica y fisiopatológica (CEAP) estandariza las manifestaciones de la enfermedad venosa de miembros inferiores. **Objetivo:** Investigar la asociación entre los sistemas venosos insuficientes y la clasificación clínica del CEAP. **Métodos:** Se realizó una investigación tipo cuantitativa, transversal, con diseño analítico, correlacional. El muestreo es no probabilístico por conveniencia. El tamaño de muestra fue 136 miembros inferiores de 71 pacientes. Se utilizó las pruebas estadísticas de Chi-cuadrado, Monte Carlo y Odd ratio (OR) con intervalos de confianza del 95 %, mediante regresión logística bivariada ($p < 0,05$). **Resultados:** El 71,8 % fue femenino con edad media de 66,1. El sistema venoso insuficiente más frecuente fue el superficial: 61,7 %. El 100% de las venas safenas mayores (VSM) dilatadas tenían insuficiencia. La clase clínica CEAP más frecuente fue la C2: 44,9 %; el 35,1 % de C1 (telangiectasia) tenían un sistema venoso insuficiente; el 50 % de C2, insuficiencia de la VSM ($p = 0,227$). Hubo una asociación entre la insuficiencia de los sistemas venosos superficial y profundo y la clasificación clínica del CEAP ($p < 0,001$). El sistema venoso profundo estuvo asociado a la enfermedad venosa crónica de miembros inferiores grave OR (6,04) con IC95 % (1,02-35,73) y $p = 0,047$. **Conclusiones:** Se evidenció una asociación entre la insuficiencia de los sistemas venosos superficial y profundo con la clasificación clínica del CEAP. Un tercio de los miembros inferiores con C1 (telangiectasias) tenían un sistema venoso insuficiente.

Palabras clave: Varices; Ecografía Doppler; Miembros inferiores; Venas. (Fuente: DeCS- BIREME)

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INTRODUCTION

Chronic Venous Disease of the Lower Limbs (CVDLL) encompasses any morphological or functional abnormality of the venous system, as opposed to Chronic Venous Insufficiency (CVI), which is diagnosed solely based on functional abnormalities using venous Doppler ultrasonography^(1,2). CVDLL is characterized by venous hypertension and stasis, resulting from valvular incompetence and/or venous flow obstruction. Superficial venous reflux is the most common cause; the venous walls become structurally weak, and the valves incompetent⁽³⁾; however, it's unclear whether this incompetence is the cause or result of venous wall dilation⁽⁴⁾. In deep veins, CVDLL occurs due to post-thrombotic valvular changes in 80% of cases and primary valvular insufficiency in 20%⁽⁵⁾. Approximately half of all CVI cases occur at multiple levels or are combined⁽⁶⁾.

CVDLL is the most common chronic vascular disease⁽⁷⁾. Its prevalence is difficult to estimate, affecting 20-40% of the adult population⁽⁸⁾, but this varies between countries⁽⁹⁾. Risk factors for CVDLL include advanced age, female gender, obesity, pregnancy, multiparity, sedentary lifestyle, family history of varicose veins, prolonged standing, smoking, elevated estrogen levels, among others^(10,11). CVDLL is associated with a wide variety of clinical presentations, including telangiectasias, varicose veins, pigmentation, edema, lipodermatosclerosis, and ulcers⁽¹²⁾. To address this complexity of clinical manifestations of CVDLL, the American Venous Forum developed a Clinical, Etiological, Anatomical, and Pathophysiological (CEAP) classification system in 1994 to provide a reliable and reproducible classification of the many manifestations of CVDLL. This was modified in 2004 and is as follows: C0: no visible signs of venous disease; C1: reticular veins or telangiectasias; C2: varicose veins; C3: edema; C4: dermal signs, subdivided into C4a (pigmentation or eczema) and C4b (lipodermatosclerosis or atrophie blanche); C5: healed ulcer; C6: active ulcer⁽¹³⁾.

From a clinical perspective, this classification incorporates various signs and symptoms of chronic venous disorders to characterize their severity. The classification ranges from asymptomatic patients to those with recurrent or active venous leg ulcers (VLUs), where quality of life tends to decline, as indicated by Silva et al.⁽¹⁴⁾, due to pain, edema, poor sleep quality,

and depression^(15,16). There are studies on the association between CVI and the CEAP clinical classification with varied results⁽¹⁷⁻²⁰⁾. The justification for the current study is that there are few studies on this topic in the Peruvian population; moreover, the relationship between segmental reflux patterns in the great saphenous vein (GSV) and the CEAP clinical classification has been little studied. The main objective of the study was to investigate the association between insufficient venous systems and the CEAP clinical classification in patients with chronic venous disease of the lower limbs, in addition to demonstrating venous system insufficiency in telangiectasias.

METHODS

This was a quantitative, cross-sectional study with an analytical and correlational design. In the venous Doppler ultrasound examination of the lower limbs, normal venous diameter measurements were taken from the 2015 Argentine consensus among radiologists and phlebologists: for the great saphenous vein: the saphenous ostium (opening) measures between 6 - 8 mm; the arch, between 5 - 6 mm; the saphenous trunk, in the thigh, measures 3 - 4.5 mm and in the infrapatellar region, 3 mm. For the small saphenous vein (SSV), the normal diameter is 1-4 mm; the diameter of perforating veins is noted when it is ≥ 3 mm⁽²¹⁾. Regarding venous insufficiency or reflux, measurements were based on the standards of the American Society for Vascular Surgery from 2022, which defines reflux as a minimum value > 500 ms of reverse flow in the superficial trunk veins - GSV, SSV (small saphenous vein), anterior accessory great saphenous vein, posterior accessory great saphenous vein - and in the tibial, deep femoral, and perforating veins. A minimum value > 1 second of reverse flow is diagnostic for reflux in the common femoral, femoral, and popliteal veins⁽²²⁾.

The 2004 CEAP clinical classification was used to standardize the clinical evaluation of patients. Additionally, CVDLL was classified as mild-moderate (C1-C3) and severe (C4-C6).

The population consisted of patients diagnosed with varicose veins of the lower limbs, with a venous Doppler ultrasound report, treated in the General Surgery office of Hospital III de Emergencias Grau de EsSalud, in the years 2022-2023.



Inclusion criteria were patients over 18 years of age, with a clinical class between C1-C6 of the CEAP classification; and exclusion criteria were patients with a surgical history or sclerotherapy for varicose veins of the lower limbs, and those with neurological, rheumatological problems, and presence or history of deep vein thrombosis. A non-probability convenience sampling was conducted. The sample size was 136 lower limbs evaluated from 71 patients.

The data collection instrument was a data sheet with closed and open alternatives, which was reliable and validated by a group of six medical experts who evaluated the relevance, consistency, and clarity of each question. The technique of inspecting data records from electronic medical records was used to compile the database. Categorical variables were expressed as numbers with percentages, and the association between variables was investigated using Pearson's Chi-square test or the Monte Carlo test, as appropriate. Odds ratios (OR) with 95% confidence intervals (CI) were

calculated using bivariate logistic regression, to determine the association between Doppler ultrasound findings and severe CVDLL. A p-value of <0.05 was considered significant. Statistical analyses were performed using IBM SPSS Statistics 26.0 software. This work complied with the Declaration of Helsinki II and the General Health Law. The study was approved by the Ethics Committee of Hospital III de Emergencias Grau.

RESULTS

The study included 71 patients, of which 71.8% were women, with an average age of 66.1 ± 12.1 years. The most frequent age group was 71-80 years, representing 29.6% of the sample. The most common insufficient venous system was the superficial system: 61.7%. All dilated great saphenous veins (GSV) had venous insufficiency (p-value ≤ 0.001 , using the Chi-square test). 3.7% of the dilated small saphenous veins (SSV) had venous insufficiency: p-value = 0.002, using the Monte Carlo test. See Table 1.

Table 1. Association between Dilatation and Insufficiency of the Great and Small Saphenous Veins.

Dilated GSV	Insufficient GSV n (%)		Total
	Yes	No	
Yes	45 (33.1)	0 (0.0)	45 (33.1)
No	28 (20.6)	63 (46.3)	91 (66.9)
Total	73 (53.7)	63 (46.3)	136 (100.0)
Dilated SSV	VSM insuficiente n (%)		Total
	Yes	No	
Yes	5 (3.7)	6 (4.4)	11 (8.1)
No	14 (10.3)	111 (81.6)	125 (91.9)
Total	19 (14.0)	117 (86.0)	136 (100.0)

GSV: Great Saphenous Vein, SSV: Small Saphenous Vein

The most frequent CEAP clinical class was C2, representing 44.9%, a group that mostly exhibited

insufficiency in both the superficial and deep venous systems. See table 2.



Table 2. Association between Insufficient Venous System and CEAP Clinical Class.

Insufficient venous system	CEAP Clinical Class n (%)					
	C1	C2	C3	C4	C5	C6
Superficial	6 (4.4)	19 (14.0)	5 (3.7)	1 (0.7)	1 (0.7)	2 (1.5)
Deep	4 (2.9)	1 (0.7)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Perforating	3 (2.2)	2 (1.5)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Superficial and Deep	3 (2.2)	21 (15.4)	0 (0.0)	1 (0.7)	1 (0.7)	3 (2.2)
Superficial, Deep and Perforating	1 (0.7)	5 (3.7)	0 (0.0)	2 (1.5)	2 (1.5)	2 (1.5)
Superficial and Perforating	2 (1.5)	6 (4.4)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Deep and Perforating	0 (0.0)	2 (1.5)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.7)
None	35 (25.7)	5 (3.7)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Total	54 (39.7)	61 (44.9)	5 (3.7)	4 (2.9)	4 (2.9)	8 (5.9)

C: Clinical Class (p-value ≤ 0.001 , using the Monte Carlo test)

39.7% of all evaluated lower limbs were C1 an insufficient venous system. (See Table 3) (telangiectasias); 35.1% of them had

Table 3. Frequency of Insufficient Venous Systems in CEAP Clinical Class C1.

CEAP Clinical Class	Insufficient Venous System n (%)							None
	Superficial	Deep	Perforating	Superficial and deep	Superficial, deep and perforating	Superficial, deep and perforating	Deep and perforating	
C1 (n=54)	6 (11.1)	4 (7.4)	3 (5.5)	3 (5.5)	1 (1.8)	2 (3.7)	0 (0.0)	35 (64.8)

In the saphenous veins, it was found that 44.1% of cases both saphenous veins. In lower limbs with CEAP C2, half had insufficiency of the GSV; 3.7% of the SSV and 9.6% of had GSV insufficiency. (See Table 4)

Table 4. Association between Incompetent Segment of Saphenous Vein and CEAP Clinical Class.

Incompetent segment of saphenous vein	CEAP Clinical Class n (%)					
	C1	C2	C3	C4	C5	C6
GSV	9 (11.5)	39 (50.0)	4 (5.1)	3 (3.8)	2 (2.6)	3 (3.8)
SSV	0 (0.0)	4 (5.1)	1 (1.3)	0 (0.0)	0 (0.0)	0 (0.0)
GSV + SSV	1 (1.3)	6 (7.7)	0 (0.0)	1 (1.3)	2 (2.6)	3 (3.8)
Total (n=78)	10 (12.8)	49 (62.8)	5 (6.4)	4 (5.1)	4 (5.1)	6 (7.7)

GSV: Great Saphenous Vein; SSV: Small Saphenous Vein; p-value = 0.227, using the Monte Carlo test

As shown in Table 5, there is a significant association between the CEAP clinical classification and the insufficiency of the SFJ, superficial and deep venous systems.

Table 5. Association between Insufficient Venous Systems and CEAP Clinical Classification.

Insufficient Venous System	CEAP Clinical Classification n (%)						p value
	C1	C2	C3	C4	C5	C6	
SFJ	2 (1.5)	34 (25.0)	4 (2.9)	3 (2.2)	3 (2.2)	3 (2.2)	<0,001 ^a
Superficial	13 (9.6)	51 (37.5)	5 (3.7)	4 (2.9)	4 (2.9)	7 (5.1)	<0,001 ^a
Deep	8 (5.9)	29 (21.3)	0 (0.0)	3 (2.2)	3 (2.2)	6 (4.4)	<0,001 ^a
Perforating	7 (5.1)	15 (11.0)	0 (0.0)	2 (1.5)	2 (1.5)	3 (2.2)	0,103 ^a

SFJ: Saphenofemoral Junction; p-value ≤ 0.05 was considered statistically significant, using the Monte Carlo test.

RESULTS

66.7% of lower limbs with mild-moderate CVDLL had great saphenous vein (GSV) insufficiency and 9.0% had insufficiency in both saphenous veins. 7.7% of lower limbs with severe CVDLL had insufficiency in both saphenous veins, with a p-value of 0.011 and assessed by the Monte Carlo test. 50.7% of lower limbs with mild-moderate CVDLL had superficial venous system insufficiency, with a p-value of 0.005 and assessed by the Chi-square test. 29.4% of lower limbs with mild-moderate CVDLL had saphenofemoral junction (SFJ)

insufficiency, with a p-value of 0.073 and assessed by the Chi-square test. 27.2% of lower limbs with mild-moderate CVDLL had deep venous system insufficiency, with a p-value of 0.001 and assessed by the Chi-square test. 16.2% of lower limbs with mild-moderate CVDLL had perforating venous system insufficiency, with a p-value of 0.020 and assessed by the Monte Carlo test. As shown in Table 6, ultrasound findings showed a significant association between severe CVDLL and deep venous system insufficiency.

Table 6. Association between Insufficient Venous System and Severe Chronic Venous Disease of Lower Limbs

Insufficient Venous System	Odds ratio (95% CI) ^a	p-value
Superficial	7.52 (0.79-71.64)	0.079
Deep	6.04 (1.02-35.73)	0.047
Perforating	3.72 (0.73-18.93)	0.113

CI: Confidence Interval; p < 0.05 was considered statistically significant; the regression was bivariate logistic.

DISCUSSION

This study demonstrated the predominance of the female gender in CVDLL, consistent with other authors^(5,17,23). The superficial venous system was the most frequently insufficient system; GSV was the most affected, similar to Taengsakul⁽⁵⁾; GSV reflux was the most common in their study population.

Andaç N et al.⁽¹⁸⁾ observed that the most common segment of GSV with reflux was above the knee. Kanchanabat et al.⁽¹⁹⁾ noted that although GSV reflux was present in most patients with lower limb CVI, SSV reflux could occur in a third of patients, especially those with lateral ulceration. In this study, all dilated GSV and nearly half of the dilated SSV were insufficient,



consistent with Choi et al.⁽²⁴⁾, who found that GSV and SSV diameters were significantly larger in patients with reflux, concluding that although vein diameter cannot be used as an absolute reference for venous reflux, it may have predictive value in patients with varicose veins. Kim et al.⁽¹²⁾ reported that this relationship was only evident in the lower part of the thigh; Yang et al.⁽⁹⁾ found that mean GSV diameters correlated with CEAP progression, but with SSV, the disease progression was less clear.

In this study, the most common clinical category was C2: 44.8%, which aligns with Taengsakul⁽⁵⁾ at 39%, unlike Porciunculla et al.⁽⁷⁾, who found C3 as the most frequent category at 60%. It was found that a third of the CEAP clinical class C1 had venous system insufficiency, of which 12.8% was of the saphenous veins, similar to Hong⁽¹⁷⁾, who found a 19.2% prevalence of saphenous vein incompetence in CEAP C1 limbs; additionally, a considerable number of limbs without varices had incompetent saphenous veins.

In this study, 44.1% of lower limbs had GSV insufficiency, 3.6% SSV, and 9.5% both, similar to Hong⁽¹⁷⁾, who reported 71% GSV reflux; 11.9% SSV reflux, and 17.1% both GSV and SSV; however, Kanchanabat et al.⁽¹⁹⁾ reported 47.2% GSV reflux; 8.1% SSV reflux, and 25.6% both. Yilmaz et al.⁽²³⁾ reported that the most common reflux pattern in patients with GSV insufficiency involved the SFJ with competent malleolar region: 48.9%. The study showed a relationship between SFJ incompetence and CEAP clinical class, unlike Porciunculla et al.⁽⁷⁾, who found no relationship, but Hong⁽¹⁷⁾ did show the correlation between incompetent SFJ and the distribution of incompetent segments in the GSV.

This work found deep venous system insufficiency in 75.5% of mild-moderate grades, much higher than Taengsakul⁽⁵⁾: 57.8%. Hong⁽¹⁷⁾ reported that among limbs with deep venous system insufficiency, 98% had popliteal vein insufficiency and 2% femoral vein insufficiency.

This study did not find an association between perforating venous system insufficiency and the CEAP clinical category. Tolu et al.⁽⁶⁾ found that varicose veins of lower limbs were related to perforating vein insufficiency in 44.7% of cases and observed a significant relationship between increased diameter of the perforating vein and the presence of perforating vein insufficiency. Huang et al.⁽²⁰⁾ found that incompetent perforating veins are a significant risk factor for dermal pigmentation.

One of the limitations of the study was the lack of uniformity in the Doppler reports, which prevented the analysis of other data such as reflux velocity, etc. The strength was that each venous system and its relationship with the clinical category were studied. It is suggested to conduct research on lower limb venous insufficiency in the Peruvian population using other classification systems such as HASTI and the Venous Clinical Severity Score, which are used to assess severity, quantify progression, and treatment outcomes of patients with CVI⁽²⁹⁾.

CONCLUSIONS

There is an association between the insufficiency of both superficial and deep venous systems and the CEAP clinical classification. One third of the lower limbs with CEAP clinical class C1 (telangiectasias) showed insufficiency of a venous system.

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