

ORIGINAL ARTICLE OPEN ACCESS

Risk Factors and Clinical Severity in Chronic Venous Disease: A New Look

Éva Badak¹  | Eszter A. Janka^{1,2}  | Patrícia Ari¹  | Edina Bodnár¹  | Krisztina Varga¹  | László Virág^{3,4}  | Éva Szabó¹ 

¹Department of Dermatology, MTA Centre of Excellence, Faculty of Medicine, University of Debrecen, Debrecen, Hungary | ²HUN-REN-UD Allergology Research Group, University of Debrecen, Debrecen, Hungary | ³Department of Medical Chemistry, MTA Centre of Excellence, Faculty of Medicine, University of Debrecen, Debrecen, Hungary | ⁴HUN-REN-UD Cell Biology and Signaling Research Group, University of Debrecen, Debrecen, Hungary

Correspondence: Éva Szabó (eszabo@med.unideb.hu)

Received: 30 October 2025 | **Revised:** 21 March 2026 | **Accepted:** 24 March 2026

Keywords: cross-sectional studies | exercise | obesity | risk factors | venous insufficiency

ABSTRACT

Background: The aim of the present study is to investigate the presence of various factors in individuals diagnosed with chronic venous disease (CVD), as compared to a control group. These factors include both those that have been empirically validated and those that remain unproven or have received less study. The second objective was to ascertain the factors influencing disease severity among patients with CVD.

Methods: A questionnaire was employed to collect data on risk factors, anthropometrics, and medical history. The study involved 209 CVD patients and 194 controls. The Venous Clinical Severity Score and the Clinical, Etiologic, Anatomic and Pathophysiologic Classification were utilized to evaluate the severity of the disease.

Results: Regular exercise was more prevalent in the control group ($p=0.001$), while prolonged sitting/standing (>8 h) was more prevalent in the patient group ($p<0.001$). Patients had higher levels of obesity and hypertension ($p<0.001$). Female gender ($p=0.010$) and family history of varicose veins ($p=0.002$) contributed to mild venous disease. Prior deep vein thrombosis ($p<0.001$), obesity ($p=0.031$), extended sitting/standing ($p=0.035$), inactivity ($p=0.001$), and family history of varicose veins ($p<0.001$) were associated with severe venous disease. Prior thrombosis was found to be associated with a more active utilization of compression therapy ($p<0.001$).

Conclusions: The findings emphasize that specific risk factors, including weight and physical inactivity, which are modifiable, correlate strongly with severe venous disease. Disease outcomes may improve through identification and modification of these factors.

1 | Introduction

The prevalence of chronic venous disease (CVD) in developing countries is approximately 2%–6% [1], whereas in developed countries it is significantly higher (60%–70%) [2–8]. This multifactorial disease has a number of well-established risk factors as extensive research has demonstrated. Several studies have shown the pivotal role of familial causes, hormonal factors, obesity [9–11], reduced physical activity, standing work,

previous venous thrombosis [1, 12, 13], and intravenous drug use on the development of CVD [14]. The extant literature offers no definitive conclusions regarding the contributions of female gender [15–18], number of births [19, 20], smoking [21, 22], and comorbidities such as cardiovascular diseases [23], hypertension, and diabetes [24–26] to the development of CVD. Further studies are required to assess the effects of these factors and to identify new risk factors for CVD. A number of factors have been identified as contributing to the development of CVD.

This is an open access article under the terms of the [Creative Commons Attribution-NonCommercial](https://creativecommons.org/licenses/by-nc/4.0/) License, which permits use, distribution and reproduction in any medium, provided the original work is properly cited and is not used for commercial purposes.

© 2026 The Author(s). *International Journal of Dermatology* published by Wiley Periodicals LLC on behalf of the International Society of Dermatology.

These include joint hypermobility [27], body height [28–30], surgery on the affected limb, traumatic injury [31], previous soft tissue infection, foot deformity [32, 33], skin diseases, arterial vasoconstriction, chronic obstructive pulmonary disease (COPD), constipation, history of tumors, phlebitis, kidney and heart disease, and oral contraceptive use [34]. Nevertheless, the extent to which these risk factors influence the severity and progression of CVD remains uncertain. However, there is a paucity of data regarding the relationship between disease severity and quality of life, as well as between compliance and treatment effectiveness. The identification of novel risk factors and establishment of associations between risk factors and disease severity are imperative for the prevention and deceleration of the progression of CVD.

The objective of the present study was to investigate the prevalence of accepted, unproven and less studied risk factors in people with CVD compared with a control group. Subsequently, the investigation was conducted into the correlation between the factors that exert influence on the severity of CVD in the patient group. The investigation further extended to the risk factors that have been previously identified in the literature but for which their role had not been unequivocally demonstrated in CVD patients. New associations between patient data and CVD were also studied. The relationships between quality of life, education, compliance, and CVD severity were also studied. Finally, the relationships between time to consult a physician, education level, severity of illness, therapeutic interventions, and quality of life were investigated.

2 | Materials and Methods

The research was conducted in accordance with the principles of the Helsinki Declaration. A comparative cross-sectional analysis of data collected in our department was performed. Patients over the age of 18 were enrolled in the study. Participation in the study was voluntary. All patients provided written consent prior to enrollment in the study. A total of 403 participants were enrolled in the study. The study comprised two groups: patient group diagnosed with CVD consists of 209 individuals, while the control group comprises 194 individuals. The sample size was determined a priori to ensure a minimum statistical power of 80% with a Type I error rate (α) of 0.05. Using a 1:1 patient-to-control ratio, the minimum required sample size was 107 subjects per group. The final achieved sample size yielded a statistical power of 96%. The patient group exhibited symptoms consistent with CVD, while the control group did not demonstrate any indications of CVD. The diagnosis of CVD was made on the basis of clinical symptoms and a Doppler ultrasound scan, a diagnostic procedure used to evaluate the involvement of the lower limb venous system (signs of previous deep vein thrombosis (DVT), valvular insufficiency, venous reflux). Patients with lower limb arterial circulatory insufficiency (as confirmed by Doppler and lack of palpable dorsalis pedis artery) were excluded from the study. A total of 403 subjects completed questionnaires, including 209 patients with CVD and 194 controls. Patients were enrolled in the study through random selection from inpatients at the Dermatology Department and patients in the Phlebology outpatient clinic of the Department. The data were collected using questionnaires. The questionnaire administered to both control subjects and patients with CVD included

a comprehensive patient and family history, as well as inquiries regarding known risk factors, unclear and suspected risk factors, subjective symptoms, and comorbidities. Additionally, the questionnaire administered to individuals with CVD incorporated the Skindex-29, a tool employed to calculate the quality-of-life index. The questionnaire also inquired about prior and current complex treatments. The clinical symptoms were characterized based on the Clinical, Etiologic, Anatomic, Pathophysiologic (CEAP) classification, which is widely used to characterize CVD, supplemented with the Venous Clinical Severity Score (VCSS). According to the CEAP classification, categories C1 (teleangiectasias or reticular veins), C2 (varicose veins) and C3 (edema) were grouped into the “mild” category, whereas categories C4 (skin symptoms: eczema, pigmentation, lipodermatosclerosis, atrophie blanche, induration), C5 (healed ulcer), and C6 (active ulcer) were grouped into the “severe” category.

2.1 | Statistical Analysis

The normality of the data was determined using the Shapiro–Wilk test. The Mann–Whitney *U* test was employed to make comparisons between continuous variables. The comparison of categorical variables was conducted through the utilization of either the chi-squared or Fisher exact tests, depending on the nature of the variable. Multivariate logistic regression analyses were performed to identify factors influencing CVD symptoms and CEAP. Odds ratios (ORs) with corresponding 95% upper and lower confidence intervals were calculated. The statistical significance was determined to be $p < 0.05$. Statistical analyses were performed with SPSS Statistics for Windows, Version 25.0 (IBM Corp., Armonk, N.Y., USA).

2.2 | Use of Artificial Intelligence

During the preparation of the revised version of the manuscript, the author(s) used Paperpal and “DeepL write” to shorten text and to improve the language and readability of the manuscript. After using this tool, the author(s) reviewed and edited the content as needed and took full responsibility for the content of the publication.

3 | Results

3.1 | Patient and Control Characteristics

A total of 403 individuals completed the questionnaire. The participants were divided into two groups: patients with CVD but without arterial insufficiency (CVD group, $N = 209$) and a control group without CVD and/or arterial insufficiency (control group, $N = 194$). The mean age of patients in the CVD and control groups did not differ significantly (61.70 ± 12.93 years vs. 61.90 ± 15.84 years, CVD vs. control, $p = 0.234$). No statistically significant differences in gender (female: 69.9% vs. 60.8%, male: 30.1% vs. 39.2%, $p = 0.057$) were detected. The mean body mass index (BMI) was significantly higher in the CVD group compared with the control group (32.00 ± 7.68 vs. 27.76 ± 4.70 , $p < 0.001$). However, no statistically significant difference in height was detected between the two groups (166.58 ± 8.57 cm vs. 165.57 ± 9.19 cm, $p = 0.162$) (Table 1).

TABLE 1 | Population characteristics.

	CVD group N=209	Control group N=194	p
Age (years) mean ± SD	61.70 ± 12.93	61.90 ± 15.84	0.234
Sex, % (N)			0.057
Male	30.1% (63)	39.2% (76)	
Female	69.9% (146)	60.8% (118)	
Educational qualification, % (N)			0.159
Primary school	34.4% (72)	26.3% (51)	
Secondary school	48.8% (102)	52.1% (101)	
University	16.8% (35)	21.6% (45)	
BMI, % (N)			<0.001
Normal	18.7% (39)	33.0% (64)	
Overweight	26.3% (55)	33.5% (65)	
Obese	55.0% (115)	33.5% (65)	
BMI (kg/m ²) mean ± SD	32.00 ± 7.68	27.76 ± 4.70	<0.001
Body height (cm) mean ± SD	166.58 ± 8.57	165.57 ± 9.19	0.162
Working type, % (N)			0.033
Sitting	23.4% (49)	35.0% (68)	
Standing	53.2% (111)	43.3% (84)	
Sitting and standing	23.4% (49)	21.7% (42)	
Working difficulty, % (N)			0.072
Light physical work	62.7% (131)	71.1% (138)	
Hard physical work	37.3% (78)	28.9% (56)	
Working hours, % (N)			<0.001
Less than 8 h sitting or standing	38.3% (80)	55.7% (108)	
More than 8 h sitting or standing	61.7% (129)	44.3% (86)	

(Continues)

TABLE 1 | (Continued)

	CVD group N=209	Control group N=194	p
Smoking habits, % (N)			0.787
Never smoking	61.7% (129)	58.8% (114)	
Quit smoking	25.8% (54)	26.8% (52)	
Smoking	12.5% (26)	14.4% (28)	
Exercise, % (N)			0.001
Never	21.1% (44)	8.2% (16)	
Occasionally	33.0% (69)	35.1% (68)	
Regularly	45.9% (96)	56.7% (110)	
Positive family history of varicose veins, % (N)			<0.001
Yes	67.9% (142)	36.6% (71)	
No	29.7% (62)	56.7% (110)	
Unknown	2.4% (5)	6.7% (13)	
Previous deep vein thrombosis in the lower extremity, % (N)			<0.001
Yes	29.2% (61)	4.6% (9)	
No	65.6% (137)	93.3% (181)	
Unknown	5.2% (11)	2.1% (4)	
Hypertension, % (N)			<0.001
Yes	74.6% (156)	62.4% (121)	
No	55.4% (53)	37.6% (73)	
Diabetes mellitus, % (N)			0.321
Yes	22.0% (46)	18.0% (35)	
No	78.0% (163)	82.0% (159)	

Note: Significant results are in bold.

Abbreviations: CVD, chronic venous disease; SD, standard deviation; N, number; BMI, body mass index.

Light physical work (62.7% vs. 71.1%, $p=0.072$) was the most common occupation type in both groups; more than half of the CVD group (53.2%) and 43.3% of the control group performed standing work. A greater proportion of individuals in the CVD group engaged in work that entailed prolonged periods (more than 8 h) of sitting or standing, in comparison to the control group ($p<0.001$). No statistically significant discrepancy in smoking habits was observed between the two groups ($p=0.787$). A statistically significant discrepancy was observed in the regularity

of physical activity among the two groups. Specifically, a higher proportion of individuals in the control group reported exercising at least once a week, in contrast to the CVD group, where approximately 21% of the subjects did not engage in any exercise ($p = 0.001$). These findings are outlined in Table 1.

The prevalence of varicose veins among family members was found to be significantly higher in the CVD cohort compared with the control group (67.9% vs. 36.6%, $p < 0.001$). A meticulous examination revealed no statistically significant disparities in the proportion of women who underwent childbirth between the two groups (91.1% vs. 87.3%, $p = 0.506$). As indicated by the results of the study, lower limb DVT ($p < 0.001$), hypertension ($p < 0.001$), and obesity ($p < 0.001$) were found to be significantly more prevalent in the CVD group compared with the control group. Conversely, the prevalence of diabetes did not demonstrate a significant difference between the two groups ($p = 0.321$) (Table 1).

The CVD patient group was categorized according to CEAP classification. Within this classification system, 80 patients were identified as being in the mild category (CEAP C1-3), while 129 patients were classified as being in the severe category (CEAP C4-6). No patients were identified in CEAP C0. In the cohort of patients diagnosed with CVD, a notable proportion had not sought consultation with a phlebologist, with 24.2% having never visited one. Furthermore, 17.3% of these patients had not sought medical attention, even in cases of more advanced C4–C6 stages. An examination of data revealed no statistically significant differences in the gender of patients who consulted a doctor among the CVD group ($p = 0.200$). A survey of patients with CVD revealed that despite the recommendation by the physician, more than 30% did not use compression therapy, and 12.5% did not use compression bandages, even in cases of active ulceration. In the CVD group, the prevalence of foot deformities was found to be 38.8%, while 17.7% of the patients underwent surgical interventions for varicose veins. Furthermore, it was observed that 58.0% of the patients did not utilize special footwear. According to the questionnaire's scoring system, 14.8% of CVD patients reported a low quality of life index, while 63.2% and 22.0% scored within the medium and high ranges, respectively.

3.2 | Multivariate Logistic Regression Models for Detecting Factors Influencing CVD Symptoms

Multinomial logistic regression models were utilized to investigate factors influencing symptoms in the CVD group (data from the VCSS scale). The regression model incorporated the following variables: age, gender, education, BMI, type and difficulty of work, duration of work without changing position, family history of varicose veins, smoking, physical activity, previous varicose vein surgery, previous lower limb DVT, and comorbidities (hypertension, diabetes, foot deformity). The odds ratio for pain experience among women was found to be 3.83 (95% confidence interval [CI]: 1.13–12.93), indicating a statistically significant difference compared to men. Edema manifested with a higher frequency in the older age group (> 65 years) (odds ratio [OR]: 4.73 [1.24; 18.00]) and in patients with a history of lower limb DVT (OR: 6.47 [1.93; 23.58]). The following factors were identified as contributing to skin pigmentation in patients: standing work (OR: 3.74 [1.32;

10.61]), obesity (OR: 4.61 [1.48; 14.37]), and a previous history of lower limb DVT (OR: 4.32 [1.66; 11.24]). A previous lower limb DVT has been demonstrated to have a substantial impact on various parameters, including inflammation (odds ratio [OR]: 2.95 [1.36; 6.44]), the prevalence of active ulcers (OR: 5.03 [2.24; 11.33]), the dimensions of active ulcers (OR: 5.04 [2.26; 11.34]), the duration of ulcer persistence (OR: 5.02 [2.24; 11.31]), and the presence of severe CVD (OR: 8.92 [2.89; 27.55]). A prior history of DVT in the lower extremity was identified as a risk factor for induration (OR: 4.73 [1.97; 11.32]), while regular physical activity (at least once per week) was found to be a protective factor for induration (OR: 0.34 [0.13; 0.95]). Patients with foot deformities exhibited a marked decrease in the utilization of compression therapy (OR: 0.45 [0.21; 0.98]), while prior DVT in the lower limb demonstrated a positive correlation with the use of compression therapy (OR: 7.57 [2.51; 22.8]). In women, advanced age (> 65 years; OR: 5.10 [1.07; 24.32]) and obesity (OR: 6.13 [1.39; 27.11]) emerged as significant risk factors for severe CVD (Table 2).

3.3 | Multivariate Logistic Regression Models to Determine Factors Influencing Severity of CVD

Patients were stratified according to CEAP. Specifically, 80 patients were classified as mild (CEAP C1–3), while 129 patients were classified as severe (CEAP C4–6). The following variables were compared between the mild and severe CEAP patient groups: age, gender, education, BMI, type and difficulty of work, duration of work without changing position, family history of varicose veins, smoking, physical activity, previous DVT in the lower extremity, and comorbidities (hypertension, diabetes). The likelihood of developing mild-stage CVD was found to be significantly higher in women (OR: 2.64 [1.26; 5.53]) and in patients with a family history of varicose veins (OR: 2.55 [1.40; 4.67]). The presence of severe CVD was found to be significantly more probable in patients with obesity (OR: 2.58 [1.14; 5.83]), particularly among those with a prior history of lower limb DVT (OR: 14.20 [5.93; 34.01]). Additionally, the study identified that patients with occupations requiring prolonged standing or sitting for more than 8 h daily (OR: 2.04 [1.05; 3.95]), and those with a family history of varicose veins (OR: 3.72 [1.98; 6.99]) were also at elevated risk. However, occasional physical activity (OR: 0.31 [0.13; 0.75]) and regular physical activity (OR: 0.20 [0.08; 0.50]) were identified as protective factors for CVD (Table 3).

4 | Discussion

This study investigated the prevalence of accepted, unproven, and less studied CVD risk factors compared with a control group and determined factors influencing CVD severity.

Prior studies have shown correlation between CEAP clinical stage and age [19, 29] and pregnancies [19, 20]. However, other studies found no association between CEAP and gender, age, or stage [35, 36]. Our study identified no correlation between disease stage and age, though mild-stage disease was more prevalent among females (Table 3). Consistent with previous findings [19], our study revealed no correlation between births and CVD. However, women with CVD experienced more pain compared to men (Table 2). A positive family history of CVD

TABLE 2 | In CVD group multivariate logistic regression models for detecting influencing factors of CVD's symptoms.

Outcomes (CVD symptoms)	Categories (influencing factors)	Variables	OR [95% CI]	p
Pain	Sex	Female/male	3.83 [1.13; 12.93]	0.031
Venous Oedema	Age	≥ 65/< 55	4.73 [1.24; 18.00]	0.023
	Previous deep vein thrombosis in the lower extremity	Yes/no	6.47 [1.93; 23.58]	0.003
Skin pigmentation	BMI	Obese/normal	4.61 [1.48; 14.37]	0.008
	Working type	Standing/sitting	3.74 [1.32; 10.61]	0.013
	Previous deep vein thrombosis in the lower extremity	Yes/no	4.32 [1.66; 11.24]	0.003
Inflammation	Previous deep vein thrombosis in the lower extremity	Yes/no	2.95 [1.36; 6.44]	0.006
Induration	Previous deep vein thrombosis in the lower extremity	Yes/no	4.73 [1.97; 11.32]	< 0.001
Number of active ulcers	Exercise	Regularly/never	0.34 [0.13; 0.95]	0.039
	Previous deep vein thrombosis in the lower extremity	Yes/no	5.03 [2.24; 11.33]	< 0.001
Active ulcer size	Previous deep vein thrombosis in the lower extremity	Yes/no	5.04 [2.26; 11.34]	< 0.001
Ulcer duration	Previous deep vein thrombosis in the lower extremity	Yes/no	5.02 [2.24; 11.31]	< 0.001
Compression therapy	Previous deep vein thrombosis in the lower extremity	Yes/no	7.57 [2.51; 22.8]	< 0.001
	Foot deformity	Yes/no	0.45 [0.21; 0.98]	0.044
CEAP-C3-6	Previous deep vein thrombosis in the lower extremity	Yes/no	8.92 [2.89; 27.55]	< 0.001
CEAP-C3-6—only among women	Age	≥ 65/< 55	5.10 [1.07; 24.32]	0.041
	BMI	Obese/normal	6.13 [1.39; 27.11]	0.017

Note: The factors used in the multivariate models were the following: age and sex of the patient, educational qualification, categorical BMI, working type, working difficulty, working hours, smoking habit, frequency of exercise, positive family history of varicose veins, previous deep vein thrombosis in the lower extremity, occurrence of hypertension, presence of diabetes mellitus, vein surgery and presence of foot deformity. Moreover, in case of CEAP-women outcome the further factor was number of child-birth. Only the significant results are shown in this Table.

Abbreviations: 95% CI, 95% confidence intervals; BMI, body mass index; C1-C3, mild; C4-C6, severe; CEAP, Clinical Etiologic Anatomic Pathophysiologic classification Clinical stages; CVD, chronic venous disease; OR, odds ratio; CEAP, Clinical Etiologic Anatomic Pathophysiologic classification Clinical stages.

was documented in 67% of the patients. Patients in both mild and severe CVD groups exhibited a higher likelihood of a positive family history (Table 3). Therefore, thorough family history is crucial for CVD diagnosis and treatment. Patients with a positive family history should undergo observation and be aware of the need for early CVD management.

We also examined potential associations between lifestyle factors and CVD. Prior research has focused on examining stage and obesity correlation [29, 37–39]. Several studies have demonstrated correlations between obesity and CEAP classification [11, 29, 36, 38]. In the present study, patients with obesity had more severe disease and skin pigmentation. Obesity and hypertension were more prevalent in the CVD cohort (Table 2), though hypertension showed no association with disease stage. Both literature data and our findings confirm obesity as an important predictor of CVD severity, contributing to leg deformity and negatively impacting muscle pump efficiency [28].

Exercise is an important factor in preventing obesity. The proportion of individuals exercising weekly was significantly higher in the control group confirming that weekly physical activity offers significant protection against CVD (Tables 1 and 3). Berard et al. reported benefits of dynamic sports such as swimming for venous insufficiency [40]. A sedentary lifestyle was strongly associated with severe CVD and induration (Tables 2 and 3) [34, 41], and patients spending 8 h daily standing or seated showed higher disease severity (Table 3). Abelyan et al. demonstrated that regular walking reduces venous insufficiency complications by 74% [31]. Unlike Meulendijks et al., our study found no significant association between smoking and CVD stage or severity, possible due to our limited sample size or lower proportion of older smokers.

Associations between prior venous disease, structural leg deviation, patient compliance, and CVD were also examined. Patients with a history of DVTs exhibit an elevated risk of severe CVD with

TABLE 3 | Multivariate logistic regression model to determine factors influencing severity in CVD group.

Outcomes reference: control	Categories (influencing factors)	Variables	OR [95% CI]	p
Mild CVD CEAP-C1-3	Sex	Female/male	2.64 [1.26; 5.53]	0.010
	Positive family history of varicose veins	Yes/no	2.55 [1.40; 4.67]	0.002
Severe CVD CEAP-C4-6	BMI	Obese/normal	2.58 [1.14; 5.83]	0.023
	Previous deep vein thrombosis in the lower extremity	Yes/no	14.20 [5.93; 34.01]	<0.001
	Working hours sitting or standing	More than 8 h/ less than 8 h	2.04 [1.05; 3.95]	0.035
	Positive family history of varicose veins	Yes/no	3.72 [1.98; 6.99]	<0.001
	Exercise	Occasionally/never	0.31 [0.13; 0.75]	0.009
		Regularly/never	0.20 [0.08; 0.50]	0.001

Note: The factors used in the multivariate model were the following: age and sex of the patient, educational qualification, categorical BMI, working type, working difficulty, working hours, smoking habit, frequency of exercise, positive family history of varicose veins, previous deep vein thrombosis in the lower extremity, occurrence of hypertension, presence of diabetes mellitus, vein surgery and presence of foot deformity. Only the significant results are shown in this Table. Abbreviations: 95% CI, 95% confidence intervals; BMI, body mass index; C1-C3, mild; C4-C6, severe; CEAP, Clinical Etiologic Anatomic Pathophysiologic classification Clinical stages; CVD, chronic venous disease; OR, odds ratio.

higher prevalence of pain, edema, skin pigmentation, inflammation, induration, multiple, larger, and persisting ulcers (Table 2), consistent with prior research linking DVT history to advanced CVD stage [19, 31, 36]. These findings underscore the need for close monitoring of patients with prior DVTs. Notably, prior lower limb DVT was positively associated with compression therapy use (Table 2); yet, despite well documented benefits [33], the majority of CVD patients with foot deformities did not wear special shoes or insoles. A recent clinical study demonstrated that compression combined with insoles reduces symptoms and improves quality of life, supporting routine foot deformity evaluation in CVD care [42]. Unlike in Campbell's [43] study, our data show no association between varicose vein surgery and progression of CVD, likely due to higher recurrence rates. Paravastu et al. noted that minimally invasive techniques may have lower recurrence than conventional surgery, but long-term evidence is limited [44]. As these techniques become more available, their [45] protective benefit and the need for regular follow up may become clearer. Patients with CVD should be counseled on lifestyle changes including diet and exercise. Approximately 25% of our patients had not consulted a specialist prior to enrollment. Contrary to Callejas et al. [41], no gender disparity in physician visit frequency was observed. High BMI, low physical activity, and DVT history were closely associated with severe CVD (CEAP 4–6). Weight management and regular physical activity are key components of disease management, primarily through patient education.

The present study has limitations: it is a single-center analysis with a modest sample size, constraining subgroup analysis. The wide 95% confidence intervals of several logistic regression models indicate the need for validation in a larger cohort.

5 | Conclusions

Our findings show that factors have varying effects on CVD severity. Genetic factors, including gender and family history, are linked to mild-stage disease (CEAP C1-3). While genetic factors

cannot be altered, patients should know they predispose to disease development. Severe venous disease (CEAP C4-6) is associated with obesity, physical inactivity, and prolonged seated or standing work. These factors are modifiable. Severe CVD patients show less engagement in exercise. Prior DVT significantly impacts CVD progression. Increased follow-up, weight control, and regular physical activity help prevent severe symptoms and slow CVD progression.

Acknowledgments

Special thanks to Karen Uray for proofreading.

Funding

This work was supported by the Hungarian National Research, Development, and Innovation Office, K147482, K132193.

Ethics Statement

The study was approved by the Hungarian Medical Research Council's Ethics Committee (Certificate numbers 45,866/2015/EKU; 0356/15, 11,811/2017/EKU).

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

References

1. I. A. Zolotukhin, E. I. Seliverstov, Y. N. Shevtsov, et al., "Prevalence and Risk Factors for Chronic Venous Disease in the General Russian Population," *European Journal of Vascular and Endovascular Surgery: The Official Journal of the European Society for Vascular Surgery* 54, no. 6 (2017): 752–758.

2. J. D. Raffetto and F. Mannello, "Pathophysiology of Chronic Venous Disease," *International Angiology: A Journal of the International Union of Angiology* 33, no. 3 (2014): 212–221.
3. R. T. Eberhardt and J. D. Raffetto, "Chronic Venous Insufficiency," *Circulation* 130, no. 4 (2014): 333–346.
4. E. Rabe, G. Berboth, and F. Pannier, "Epidemiology of Chronic Venous Diseases," *Wiener Medizinische Wochenschrift* (1946) 166, no. 9–10 (2016): 260–263.
5. K. Böhler, "Venous Ulcer," *Wiener Medizinische Wochenschrift* 166, no. 9–10 (2016): 287–292.
6. E. Rabe, J. J. Guex, A. Puskas, A. Scuderi, and Q. F. Fernandez, "Epidemiology of Chronic Venous Disorders in Geographically Diverse Populations: Results From the Vein Consult Program," *International Angiology: A Journal of the International Union of Angiology* 31, no. 2 (2012): 105–115.
7. T. L. Carman and A. Al-Omari, "Evaluation and Management of Chronic Venous Disease Using the Foundation of CEAP," *Current Cardiology Reports* 21, no. 10 (2019): 114.
8. M. Stücker, E. Rabe, K. Meyer, B. Ottillinger, and T. Schütt, "Therapeutic Approach to Chronic Venous Insufficiency - Clinical Benefits of Red-Vine-Leaf-Extract AS 195 (Antistax®)," *Die Pharmazie* 74, no. 4 (2019): 193–200.
9. A. C. Seidel, C. E. Belczak, M. B. Campos, R. B. Campos, and D. S. Harada, "The Impact of Obesity on Venous Insufficiency," *Phlebology* 30, no. 7 (2015): 475–480.
10. Z. K. Deol, S. Lakhanpal, G. Franzon, and P. J. Pappas, "Effect of Obesity on Chronic Venous Insufficiency Treatment Outcomes," *Journal of Vascular Surgery. Venous and Lymphatic Disorders* 8, no. 4 (2020): 617–628.e1.
11. H. O. Davies, M. Popplewell, R. Singhal, N. Smith, and A. W. Bradbury, "Obesity and Lower Limb Venous Disease - The Epidemic of Phleboesity," *Phlebology* 32, no. 4 (2017): 227–233.
12. A. I. Diken, A. Yalçinkaya, E. Aksoy, et al., "Prevalence, Presentation and Occupational Risk Factors of Chronic Venous Disease in Nurses," *Phlebology* 31, no. 2 (2016): 111–1117.
13. R. H. Malkani, R. Karia, and S. Thadani, "A Study of Risk Factors of Chronic Venous Insufficiency and Its Association With Features Suggestive of Preceding or Present Deep Venous Thrombosis," *Indian Journal of Dermatology* 64, no. 5 (2019): 366–371.
14. J. Doran, V. Hope, T. Wright, J. Scott, D. Ciccarone, and M. Harris, "Prevalence and Factors Associated With Chronic Venous Insufficiency, Leg Ulceration and Deep-Vein Thrombosis Among People Who Inject Drugs in London, UK," *Drug and Alcohol Review* 41 (2021): 677–685.
15. I. A. Zolotukhin, E. I. Seliverstov, Y. N. Shevtsov, I. P. Avakians, A. M. Tatarintsev, and A. I. Kirienko, "Risk Factors for Venous Symptoms in Russian Patients With Chronic Venous Disease," *Current Medical Research and Opinion* 35, no. 9 (2019): 1583–1587.
16. A. F. Khan, R. Chaudhri, M. A. Ashraf, M. S. Mazaffar, S. Zawarul-Imam, and M. Tanveer, "Prevalence and Presentation of Chronic Venous Disease in Pakistan: A Multicentre Study," *Phlebology* 28, no. 2 (2013): 74–79.
17. Y. Kavousi, Z. Al Adas, E. Karamanos, N. Kennedy, L. S. Kabbani, and J. C. Lin, "Men Present With Higher Clinical Class of Chronic Venous Disease Before Endovenous Catheter Ablation," *Journal of Vascular Surgery. Venous and Lymphatic Disorders* 6, no. 6 (2018): 702–706.
18. L. Stătescu, D. Văță, E. Andrese, and L. G. Solovăstru, "Chronic Venous Disease Cases at the Iași Dermatology Clinic," *Revista Medico-Chirurgicală A Societății de Medici și Naturaliști din Iași* 118, no. 4 (2014): 1000–1007.
19. M. Matić, A. Matić, Z. Gajinov, Z. Golušin, S. Prčić, and B. Jeremić, "Major Risk Factors for Chronic Venous Disease Development in Women: Is Childbirth Among Them?," *Women & Health* 59, no. 10 (2019): 1118–1127.
20. P. Jain, A. Savlania, A. Behera, and U. Gorski, "Distribution Patterns of Pathological Venous Reflux and Risk Factors in Patients With Skin Changes due to Primary Venous Disease in North India," *Phlebology* 36, no. 3 (2021): 209–216.
21. S. Yuan, M. Bruzelius, S. M. Damrauer, and S. C. Larsson, "Cardiometabolic, Lifestyle, and Nutritional Factors in Relation to Varicose Veins: A Mendelian Randomization Study," *Journal of the American Heart Association* 10, no. 21 (2021): e022286.
22. A. J. Lee, L. A. Robertson, S. M. Boghossian, et al., "Progression of Varicose Veins and Chronic Venous Insufficiency in the General Population in the Edinburgh Vein Study," *Journal of Vascular Surgery. Venous and Lymphatic Disorders* 3, no. 1 (2015): 18–26.
23. J. H. Prochaska, N. Arnold, A. Falcke, et al., "Chronic Venous Insufficiency, Cardiovascular Disease, and Mortality: A Population Study," *European Heart Journal* 42 (2021): 4157–4165.
24. P. Matic, S. Jolic, S. Tanaskovic, et al., "Chronic Venous Disease and Comorbidities," *Angiology* 66, no. 6 (2015): 539–544.
25. V. Fejfarová, K. Roztočil, A. Svědřínková, et al., "The Relationship Between Chronic Venous Insufficiency and Diabetes Mellitus," *International Angiology: A Journal of the International Union of Angiology* 36, no. 1 (2017): 90–91.
26. J. S. Mervis, R. S. Kirsner, and H. Lev-Tov, "Protocol for a Longitudinal Cohort Study: Determination of Risk Factors for the Development of First Venous Leg Ulcer in People With Chronic Venous Insufficiency, the VEINS (Venous Insufficiency in South Florida) Cohort," *BMJ Open* 9, no. 1 (2019): e023313.
27. K. Azma, P. Mottaghi, A. Hosseini, S. Salek, and R. Bina, "Venous Insufficiency After Prolonged Standing: Is Joint Hypermobility an Important Risk Factor?," *Advanced Biomedical Research* 4 (2015): 98–102.
28. J. Spáčil, "Does Body Height Affect the Severity of Chronic Venous Disease in Lower Extremities?," *Vnitřní Lékařství* 61, no. 3 (2015): 202–206.
29. D. Musil, M. Kaletova, and J. Herman, "Age, Body Mass Index and Severity of Primary Chronic Venous Disease," *Biomedical Papers of the Medical Faculty of the University Palacky, Olomouc, Czechoslovakia* 155, no. 4 (2011): 367–371.
30. F. G. Fowkes, A. J. Lee, C. J. Evans, P. L. Allan, A. W. Bradbury, and C. V. Ruckley, "Lifestyle Risk Factors for Lower Limb Venous Reflux in the General Population: Edinburgh Vein Study," *International Journal of Epidemiology* 30, no. 4 (2001): 846–852.
31. G. Abelyan, L. Abrahamyan, and G. Yenokyan, "A Case-Control Study of Risk Factors of Chronic Venous Ulceration in Patients With Varicose Veins," *Phlebology* 33, no. 1 (2018): 60–67.
32. S. Bonkemeyer Millan, R. Gan, and P. E. Townsend, "Venous Ulcers: Diagnosis and Treatment," *American Family Physician* 100, no. 5 (2019): 298–305.
33. J. F. Uhl, M. Chahim, and F. A. Allaert, "Static Foot Disorders: A Major Risk Factor for Chronic Venous Disease?," *Phlebology* 27, no. 1 (2012): 13–18.
34. A. M. Meulendijks, F. M. C. de Vries, A. A. van Dooren, M. J. Schuurmans, and H. A. M. Neumann, "A Systematic Review on Risk Factors in Developing a First-Time Venous Leg Ulcer," *Journal of the European Academy of Dermatology and Venereology: JEADV* 33, no. 7 (2019): 1241–1248.
35. Ł. Dzieciuchowicz, Z. Krasinski, K. Motowidlo, and M. Gabriel, "The Aetiology and Influence of Age and Gender on the Development of Advanced Chronic Venous Insufficiency in the Population of Patients of Semi-Urban County Outpatient Vascular Clinic in Poland," *Phlebology* 26, no. 2 (2011): 56–61.

36. H. Vlajinac, J. Marinkovic, M. Maksimovic, and D. Radak, "Factors Related to Venous Ulceration: A Cross-Sectional Study," *Angiology* 65, no. 9 (2014): 824–830.
37. A. M. van Rij, C. S. De Alwis, P. Jiang, et al., "Obesity and Impaired Venous Function," *European Journal of Vascular and Endovascular Surgery: The Official Journal of the European Society for Vascular Surgery* 35, no. 6 (2008): 739–744.
38. L. Vines, G. Gemayel, and J. T. Christenson, "The Relationship Between Increased Body Mass Index and Primary Venous Disease Severity and Concomitant Deep Primary Venous Reflux," *Journal of Vascular Surgery. Venous and Lymphatic Disorders* 1, no. 3 (2013): 239–244.
39. J. P. Benigni, M. Cazaubon, A. Tourneroc, I. Achhammer, and M. Mathieu, "Is Obesity an Aggravating Factor in Chronic Venous Disease? Results of a French Epidemiological Study in Male Patients," *International Angiology: A Journal of the International Union of Angiology* 25, no. 3 (2006): 297–303.
40. A. Bérard, L. Abenhaim, R. Platt, S. R. Kahn, and O. Steinmetz, "Risk Factors for the First-Time Development of Venous Ulcers of the Lower Limbs: The Influence of Heredity and Physical Activity," *Angiology* 53, no. 6 (2002): 647–657.
41. J. M. Callejas and J. Manasanch, "Epidemiology of Chronic Venous Insufficiency of the Lower Limbs in the Primary Care Setting," *International Angiology: A Journal of the International Union of Angiology* 23, no. 2 (2004): 154–163.
42. J. F. Uhl, M. Chahim, and F. A. Allaert, "Compression Versus Inner Sole for Venous Patients With Foot Static Disorders: A Prospective Trial Comparing Symptoms and Quality of Life," *Phlebology* 30, no. 1 (2015): 32–38.
43. W. B. Campbell, A. Vijay Kumar, T. W. Collin, K. L. Allington, and J. A. Michaels, "The Outcome of Varicose Vein Surgery at 10 Years: Clinical Findings, Symptoms and Patient Satisfaction," *Annals of the Royal College of Surgeons of England* 85, no. 1 (2003): 52–57.
44. S. C. Paravastu, M. Horne, and P. D. Dodd, "Endovenous Ablation Therapy (Laser or Radiofrequency) or Foam Sclerotherapy Versus Conventional Surgical Repair for Short Saphenous Varicose Veins," *Cochrane Database of Systematic Reviews* 11, no. 11 (2016): Cd010878.
45. T. F. O'Donnell, E. M. Balk, M. Dermody, E. Tangney, and M. D. Iafrati, "Recurrence of Varicose Veins After Endovenous Ablation of the Great Saphenous Vein in Randomized Trials," *Journal of Vascular Surgery. Venous and Lymphatic Disorders* 4, no. 1 (2016): 97–105.