

Original Article

Risk factors for chronic venous insufficiency in nurses in Türkiye - NueVo TR

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Abstract

Aim: Chronic venous insufficiency (CVI) is a condition that results from obstruction, valve insufficiency, dysfunction of calf muscle pump, or their combinations. This study analyzed the risk factors and demographic characteristics of CVI in nurses in Türkiye. Additionally, it seeks to identify the total number of patients treated at medical centers in 2022 and assess the prevalence of CVI.

Material and Methods: This multicenter, descriptive, and cross-sectional study was conducted with the participation of nurses working in 18 centers. Nurses completed a questionnaire that included their demographic information and venous insufficiency risk factors, and the Venous Insufficiency Epidemiological and Economic Study-Quality of Life Questionnaire. Researchers also completed the Standard CEAP Form Section C. The cases were divided into 2 groups: CVI (-) group (n=776, 43.5%) and CVI (+) group (n=1010, 56.5%).

Results: A total of 1786 nurses participated in this study. Older age (>30-39 years), female gender, ≥ 2 pregnancies, ≥ 2 childbirths, years in the profession (>5-15 years), family history, and night cramps were identified as risk factors for CVI ($p<0.001$). No significant difference was found between smoking, body mass index, and CVI status ($p>0.05$). Hypertension, diabetes, and a history of deep vein thrombosis were the most common coexisting diseases. With a one-unit increase in age, risk of CVI increased 1.1-fold, family history of VV increased CVI risk 1.9-fold and presence of nocturnal night cramps increased risk of CVI 2.6-fold. The prevalence of CVI in 2022 was found to be 22.66% in this study.

Conclusion: Older age, female gender, ≥ 2 pregnancies, ≥ 2 childbirths, years in the profession, family history, and night cramps are identified as risk factors for CVI in nurses. Common comorbid diseases include hypertension, diabetes, and a history of DVT. Pregnancy, particularly with multiple occurrences, stands out as a critical period for CVI. Reported symptoms in CVI (+) nurses include leg pain, swelling, heaviness, restless legs, and throbbing. Nurses demonstrate a higher incidence of CVI compared to other professions, highlighting an occupational risk. These findings stress the importance of preventive measures for nurses.

Keywords: Chronic venous insufficiency, varicose veins, prevalence, incidence, nurse

INTRODUCTION

Chronic venous insufficiency (CVI) results from various factors such as obstruction, valve incompetence, and impaired muscle pump function, affecting both superficial and deep leg veins [1]. Its prevalence ranges from 1-40% in women and 1-27% in men, with an annual incidence rate of 2.6% in women and 1.9% in men [2].

Major risk factors include genetic predisposition, age, prolonged standing, thrombophlebitis history, lower extremity trauma, female gender, obesity, low physical activity, high blood pressure, smoking, and pregnancy. Valvular damage in CVI leads to venous reflux, causing increased pressure, capillary dilation, and the formation of pericapillary fibrin cuffs, impairing tissue oxygenation. Prolonged standing in CVI patients results in increased pain and edema, with symptoms including varicose veins (VV), pigmentation, lipodermatosclerosis, and venous ulcers [1,3,4]. The classification developed for CVI, known as CEAP, is used to define the clinical (C), etiological (E), anatomical (A), and pathophysiological (P) characteristics of this disease [5].

Varicose veins, a significant manifestation of CVI, pose a public health concern due to their high prevalence, impacting work productivity and individuals' quality of life, with notable epidemiological and socio-economic consequences. Nursing profession, involving prolonged standing, is identified as a high-risk group for CVI [6].

In a study with 203 nurses from Iran, varicose vein prevalence was 72.4%, with higher rates in women (77.9% vs. 56.9%). Risk factors included increased years of service, long working

hours, overtime, and higher body mass index [7]. Another study with 414 nurses in a university hospital found varicose vein prevalence to be 16.18%, identifying age and standing for more than four hours as risk factors [6]. In a separate study, varicose vein prevalence was 88.2% in female and 11.8% in male nurses, with a significant correlation between standing duration and varicose vein occurrence [8,9]. The clinical manifestation of CVI significantly impacts the quality of life of nurses, thereby reducing their work performance. As integral components of healthcare systems, nurses play a crucial role, and such conditions can lead to interruptions in the provision of healthcare services and, additionally, the allocation of economic resources for treatment [10].

The aim of this study is to analyze the risk factors and demographic characteristics of venous insufficiency in nurses working in a total of 18 centers, including 11 education and research and 7 university hospitals. The study also aims to determine the total number of patients who sought medical care at the 18 centers in 2022 and calculate the prevalence of patients diagnosed with CVI among this patient population.

MATERIAL AND METHODS

This multicenter, descriptive, and cross-sectional study was conducted with the participation of nurses working at a total of 18 centers (across 11 cities), of which 11 are education and research, and 7 are university hospitals. A total of 1786 nurses participated in this study. Necessary permissions were obtained from the Institutional Review Board and Ethics Committee of Başkent University Faculty of Medicine and Health Sciences for this research (Project number: KA23/153, 23/91, Date: 26.04.2023). Subsequently, permissions were also obtained from

the relevant departments of the 18 centers where the study was to be conducted. In addition, written and verbal consent were obtained from the participating nurses.

The inclusion criteria for the study required participants to be part of the nursing staff at the respective centers and to willingly sign the Informed Consent Form (ICF) indicating their consent to participate. Nurses who were under the age of 18 and those who did not sign the ICF were excluded from the study.

All participating nurses filled questionnaires regarding their demographic characteristics and venous insufficiency risk factors and quality of life, then they were all clinically examined by the researchers for their CVI status. The Standard CEAP Form Section C was used to determine CVI grades from C0 to C6, and if nurses had CVI or not (CVI (+) or CVI (-)). While nurses answered the questions referring to their whole lives up to the time of the questionnaire, clinical examinations by the researchers were performed currently. All results were recorded to an electronic case report form (e-CRF) system.

The C0 group was considered as the CVI (-) group (n=776, 43.5%), and the C1, C2, C3, and C4a groups were considered as the CVI (+) group (n=1010, 56.5%). The CEAP classification of nurses is presented in Table 1.

Table 1. CEAP classification of participants		
	n	%
C0	776	43.5%
C1	681	38.1%
C2	226	12.7%
C3	86	4.8%
C4a	17	0.9%
Total	1786	100%

Additionally, to calculate the incidence of CVI, researchers obtained access to the total number of patients admitted to hospitals, the total number of patients in outpatient clinics, and the number of patients diagnosed with CVI in outpatient clinics of their respective centers in the year 2022. They accessed this information after obtaining approval from the relevant departments and entered these data into the e-CRF system as well.

Data Collection Process

Data were collected over the internet using the e-CRF application between June 1, 2023 and August 31, 2023. User accounts were created for the primary investigators and sub-investigators of the 18 centers included in the study. Investigators entered data for their respective centers and made updates if necessary. The data manager checked the entered data for compliance with the study and opened queries for the data fields deemed necessary. The queries opened were answered by the relevant center researcher and the data were updated when necessary. The data manager

closed the queries with appropriate answers and locked the cases with completed data control. The data cleaning process was completed on the electronic case report form and the database was locked after the data control of all cases and the data set was made ready for statistical analysis.

Data Collection Forms

Twenty-four physicians from 18 centers participated as researchers in the study. When these physicians first accessed the e-CRF system, they entered data obtained from their electronic patient record systems for the questions ‘What is the total number of patients who sought medical care at your hospital in the year 2022?’ and ‘How many patients were diagnosed with CVI among those who presented to your hospital in the year 2022?’ These data were collected with additional permissions from all hospital management. Subsequently, these data were recorded as common information for all cases and analyzed.

Form for Determining Demographic Characteristics and Venous Insufficiency Risk Factors of Nurses: This form consists of two sections. The first section, which is completed by the nurses, includes questions pertaining to age, gender, height, weight, body mass index (BMI), the number of pregnancies and childbirths, the unit nurses work in, years spent in the profession, average daily standing time, comorbidities, smoking status, exercise habits, bowel habits, family history of varicose veins and flat feet, previous diagnoses of VV or CVI, and treatment related to CVI.

In the second section, completed by the nurses, the Venous Insufficiency Epidemiological and Economic Study-Quality of Life Questionnaire (VEINES-QOL/Sym) [11] was administered. Approximately 10 minutes were allocated for the completion of these forms.

The Standard CEAP Form Section C: This section was completed by physicians [5,12].

The severity of chronic venous disorder is classified into ten clinical grades as follows.

- C0=No visible or palpable signs of venous disease
- C1=Telangiectasia or reticular veins
- C2=Varicose veins, C2r=Recurrent
- C3=Edema
- C4=Skin changes due to venous disease
- C4a=Pigmentation, eczema
- C4b=Lipodermatosclerosis, white atrophy
- C4c=Corona phlebectatica
- C5=Healed ulcer with skin changes
- C6=Active venous ulcer, C6r=Recurrent

Participants' CVI status was also determined with the use of The

Standard CEAP Form Section C. Only C0 status was appointed as CVI (-).

Sample Size Calculation

The following formula was used to calculate the required sample size for estimating the population proportion:

$$n = \frac{N * Z_{\alpha/2}^2 * p * (1 - p)}{(N - 1) * d^2 + Z_{\alpha/2}^2 * p * (1 - p)}$$

n: The sample size.

Z: Determines the Z-score for the confidence interval (for example, Z=1.96 for a 95% confidence level).

p: Represents the estimated population percentage.

d: Represents the margin of error (standard error).

Since there were no clear data in literature on CVI rate in nurses in Türkiye, by using 0.5 as an estimate for p in the sample size formula, we would get the largest required sample size for the confidence level and margin of error we selected. In this regard, the minimum sample size required for the study was calculated to be 370 nurses with n known, $\alpha=0.05$, $d=0.05$, and $p=0.50$. Considering a potential 20% sample loss during the study, it was planned to include at least 444 nurses in the study.

Statistical Analysis

With a questionnaire, risk factors of nurses for CVI were planned to be analyzed. Descriptive analysis of these factors provided information on the subject.

Shapiro Wilk test was used for assessing whether the variables followed normal distribution or not. Continuous variables were presented as mean±standard deviation and median (minimum:maximum) values. Categorical variables were reported as n (%). According to the normality test results, Mann Whitney U test was used in comparison between two groups. Pearson Chi-squared test or Fisher's exact test was used for comparing categorical variables. Multiple logistic regression analysis was performed to determine the risk factors affecting the incidence of CVI. Variables were included in multiple logistic regression model by using forward LR method. The variables found to be significant in the model were determined as independent variables. Multiple logistic regression models were found to be significant ($p<0.001$). SPSS (IBM Corp. Released 2021 IBM SPSS Statistics for Windows, Version 28.0, Armonk, NY: IBM Corp.) was used for statistical analysis and a p value <0.05 was considered statistically significant.

RESULTS

A total of 1786 nurses from 18 centers participated, with 79.34% (n=1417) being women. Medians of age was 31 (22-69), height was 165cm (135-195), weight was 65kg (37-125), and BMI was

23.94 (14.37-43.03). The majority, 82.25% (n=1469), reported a daily standing time of ≥ 6 hours.

The CVI (+) group had a median age of 35 (22-69), while the CVI (-) group had a median age of 29 (22-59) ($p<0.001$). Median height of the CVI (+) group was 164 cm (148-190), CVI (-) group was 168 cm (135-195) ($p<0.001$). A statistically significant difference existed between the groups in terms of years in the profession ($p<0.001$). The median professional experience in the CVI (-) group was 6 years (1-41), whereas in the CVI (+) group, it was 12 years (1-42).

The demographic information, including gender, age, BMI, pregnancy status, number of childbirths, years in the profession, and smoking status of the groups is presented in Table 2.

Table 2. Comparative analysis of demographic information of CVI (+) and CVI (-) groups

	CVI (-) n (%)	CVI (+) n (%)	p
Gender			
Female	519 (36.6%)	898 (63.4%)	<0.001 ^a
Male	257 (69.6%)	112 (30.4%)	
Age			
20-29	424 (56.0%)	333 (44.0%)	<0.001 ^b
30-39	207 (41.5%)	292 (58.5%)	
40-49	126 (28.2%)	321 (71.8%)	
50+	19 (22.9%)	64 (77.1%)	
BMI			
Underweight (<18.5)	56 (65.1%)	30 (34.9%)	>0.05 ^c
Normal (18.5-25)	422 (41.7%)	590 (58.3%)	
Overweight (>25)	298 (43.3%)	390 (56.7%)	
Pregnancy status			
No pregnancy	322 (47.4%)	358 (52.6%)	<0.001 ^b
1 pregnancy	91 (32.5%)	189 (67.5%)	
≥ 2 pregnancies	106 (23.2%)	351 (76.8%)	
Number of childbirths			
No childbirth	17 (54.8%)	14 (45.2%)	<0.001 ^b
1 childbirth	91 (32.5%)	189 (67.5%)	
≥2 childbirths	106 (23.2%)	351 (76.8%)	
Years in the profession			
Less than 5 years	304 (62.7%)	181 (37.3%)	<0.001 ^b
5-15 years	298 (44.1%)	377 (55.9%)	
15-25 years	118 (30.4%)	270 (69.6%)	
More than 25 years	56 (23.5%)	182 (76.5%)	
Smoking status			
Non-smoker	523 (43.3%)	684 (56.7%)	0.884 ^a
Smoker	253 (43.7%)	326 (56.3%)	

Data are expressed as n(%). a: Fisher's Exact Test, b: Linear-by-Linear Association, c: Fisher-Freeman-Halton Exact Test.

A difference was found between the groups regarding daily average standing time ($p=0.042$). Among those standing ≤ 6 hours daily, CVI was observed in 51.4%, while in those standing ≥ 6 , it was observed in 57.7%.

Additionally, a difference was identified between the groups based on their distribution in working units ($p=0.005$). Among participants in the nursing management services unit, CVI was observed in 71.1% (Figure 1).

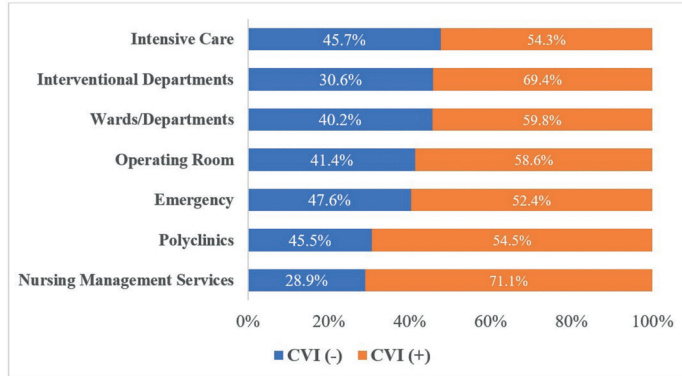


Figure 1. Distribution of the working units

A difference was observed between the groups based on exercise status ($p=0.010$) (Figure 2).

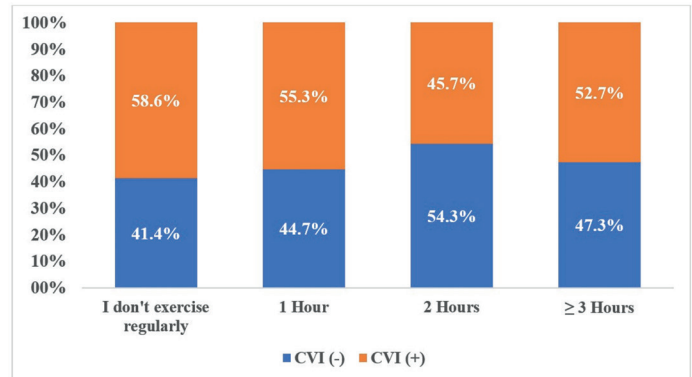


Figure 2. Exercise status

The comparative analysis of bowel movements, foot arch characteristics, and the presence of VV in the family is presented in Table 3.

In the questionnaire, 369 (20.66%) of the nurses stated they had accompanying diseases which are listed in Figure 3.

Table 3. Comparative analysis of other parameters

	CVI (-) n (%)	CVI (+) n (%)	p
Bowel movements			
Regular	655 (46.0%)	769 (54.0%)	<0.001 ^a
Irregular	121 (33.4%)	241 (66.6%)	
Footbed			
Pes planus	38 (44.0%)	70 (56.0%)	0.074 ^a
Normal	738 (35.2%)	940 (64.8%)	
Family history of VV			
No	523 (51.1%)	500 (48.9%)	<0.001 ^a
Yes	253 (33.2%)	510 (66.8%)	

Data are expressed as n (%). a: Fisher's Exact Test

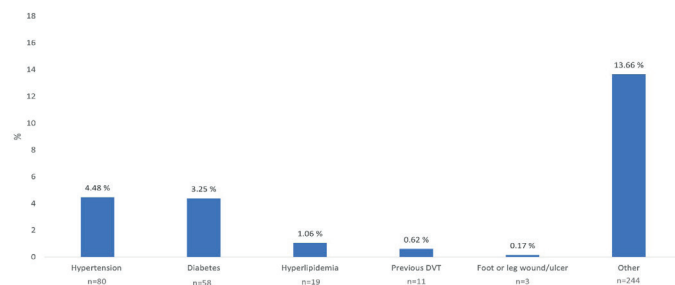


Figure 3. The distribution of accompanying diseases

Statistical differences were observed in the CVI (+) group for hypertension ($p=0.013$), diabetes ($p=0.013$), and a history of deep vein thrombosis (DVT) ($p=0.029$). However, no significant difference was found between the groups regarding

hyperlipidemia ($p=0.130$) and the presence of foot or leg ulcers ($p=0.262$) (Table 4).

Table 4. Comparative analysis of comorbidities

	CVI (-) n (%)	CVI (+) n (%)	p
Diabetes	16 (27.6%)	42 (72.4%)	$p=0.013^a$
Hypertension	24 (30.0%)	56 (70.0%)	$p=0.013^a$
Deep vein thrombosis	1 (9.1%)	10 (90.9%)	$p=0.029^a$
Hyperlipidemia	5 (26.3%)	14 (73.7%)	$p=0.130^a$
Foot or leg ulcers	0 (0.0%)	3 (9.4%)	$p=0.262^a$

Data are expressed as n(%). a: Fisher's Exact Test

The distribution of treatment status is shown in Figure 4.

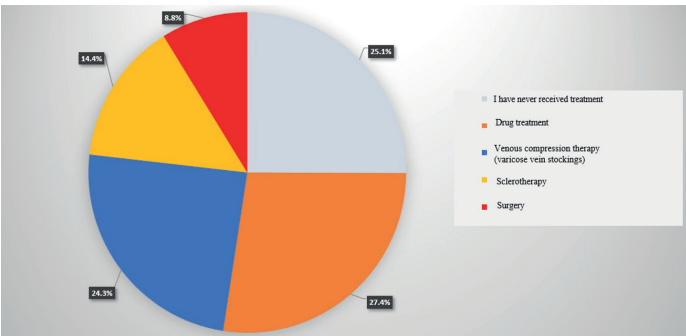


Figure 4. The distribution of treatment status

Statistical differences were found between the two groups in terms of leg fullness, pain, swelling, cramps, heat/burning sensation, throbbing, itching, tingling, and restlessness in the legs ($p<0.001$) (Figure 5).

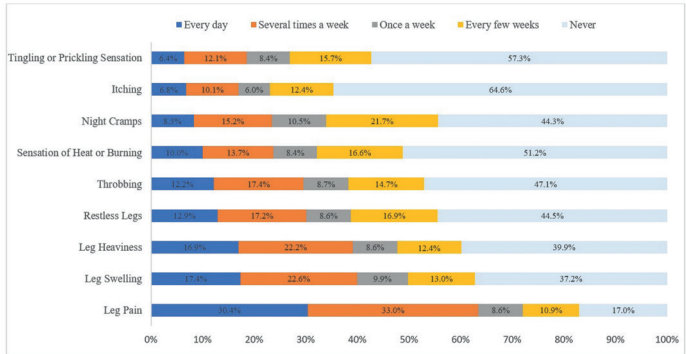


Figure 5. The distribution of complaints

The logistic regression model was found to be significant ($p<0.001$). With a one-unit increase in the age of participants, risk of CVI increased 1.1-fold. A family history of VV increased the CVI risk 1.9-fold. Experiencing nocturnal night cramps increased the risk of CVI 2.6-fold.

A logistic regression analysis was conducted to identify the risk factors affecting the incidence of CVI. The forward selection approach was adopted as the variable selection method. Upon examining the analysis results, it was observed that the logistic regression model obtained was consistent with the data (Hosmer and Lemeshow test, $p=0.961$) and the obtained logistic regression model was also significant ($p<0.001$). Risk factors thought to be influential on the incidence of CVI through the forward selection approach are reported in Table 5.

Table 5. The logistic regression analysis					
Ref. Cat.	Wald	OR	95% CI		p
			Lower	Upper	
Age	17.6	1.1	1.0	1.1	0.000
Family history of VV	10.4	1.9	1.3	2.7	0.001
Nocturnal night cramps	26.7	2.6	1.8	3.7	0.000

OR: Odds Ratio, Ref. Cat.: Reference Category, CI: Confidence interval

DISCUSSION

Since CVI and VV are not considered life-threatening conditions, they are often overlooked as a major public health issue. However, these conditions affect a significant portion of the population and reduce the quality of life of those affected. All these factors emphasize the importance of a more detailed examination of risk factors.

Older age was identified as a significant risk factor for CVI, with a reported 2.42-fold increased risk of VV [13]. Our study revealed that the mean age of the CVI (+) nurses was 35, and the prevalence of CVI increased with age. The ratio of CVI (+) was 44% among those aged 20-29, rising to 77.1% in individuals over 50 ($p<0.001$) (Table 2). Epidemiological studies consistently show an age-related increase in CVI prevalence in both genders [14,15], with a 6% increase in risk for each year of age [16,17]. Female gender is widely recognized as a risk factor for chronic venous disease (CVD), and in our study, 63.4% of the female nurses were CVI (+) whereas 30.4% of male nurses were CVI (+) ($p<0.001$). Similar to our findings, other studies have reported no significant difference in CVI occurrence among women who have not given birth [18].

Pregnancy represents a crucial period for the lower extremity venous system [19], with studies indicating an increased incidence of VV linked to the number of childbirths [14,20]. In this study, the rate of CVI (+) was significantly higher at 76.8% for pregnancy status ≥ 2 and number of childbirths ≥ 2 ($p<0.001$). No significant difference was found between smoking, BMI, and CVI status ($p>0.05$), in parallel with the findings of Ali et al., who also reported no difference between smoking and CVI [8].

Analyzing years in the profession revealed a CVI (+) rate of 37.3% for nurses with ≤ 5 years of service, escalating to 76.5% for nurses with ≥ 25 years of service ($p<0.001$). Those with more years of service are at a higher risk for the presence and intensity of VV [21]. However, when analyzing the units worked in, among participants in the nursing management services unit, CVI was observed in 71.1%. The elevated prevalence can be attributed to the advanced age demographic observed among nurses employed in the nursing management services unit.

In our study, the incidence of CVI was significantly higher among individuals who do not engage in regular exercise compared to those who do ($p=0.010$). This study is consistent with the literature showing the positive impact of exercise on the symptoms of patients with CVD [22-24]. We also identified a statistical correlation between family history and worsening of VV, consistent with prior research [7,13,25] although some studies reported no such correlations [26]. Similarly, no significant correlation was found between bowel movements and varicose intensity, in contrast to some literature [27,28]. Irregular

bowel movements were prevalent in the CVI (+) group, in parallel with Lee et al.'s study [29]. Notably, our study revealed significant differences in bowel movements and family history within the CVI (+) group, while no such differences were found in the footbed group.

Hypertension, heart failure, peripheral arterial disease, chronic obstructive pulmonary disease, diabetes mellitus, and skeletal system or joint diseases are some of the prevalent comorbidities associated with CVD [30]. In the Beebe-Dimmer et al.'s study, hypertension was considered as a risk factor for VV and CVI, but more studies are needed [31]. Upon review of the medical history of our patients, hypertension, diabetes, and a history of DVT were observed to be more prevalent in the CVI (+) group. However, there was no significant difference between the groups regarding hyperlipidemia and the presence of foot or leg ulcers.

Majority of the nurses in our study were C0 (43.5%), while 38.1% were C1, 12.7% were C2 and 4.8% were C3. Compared to studies from Iran and Thailand, our findings were comparable [7,9]. In our study, participant nurses filled in the questionnaires themselves regarding their whole lives, then clinicians examined participating nurses' current states. As a result, numbers expressed by the nurses were generally higher than clinical examination results. In the questionnaire results, nurses stated that 8.8% underwent surgery for VV, but in current clinician examinations, there were only 4.8% C3 and 0.9% C4a cases. Similarly, there were no C5 or C6 cases according to clinical examinations, but several nurses stated they have/had foot ulcers. These ulcers may have been related to CVD and healed before clinical examination or they might be current lesions that are not related to CVD at all.

In patients with severe C4-6 CVD, conservative treatment involving compression and medications is the primary option [32]. Literature emphasizes decompression therapy, with a Cochrane review noting the significant reduction in ulcer recurrence with compression in one study involving 979 participants [33,34]. This study reveals significant differences in medication treatment and compression therapy in CVI (+) group, while sclerotherapy and surgical intervention show no difference. Common daily complaints include leg pain, leg swelling, leg heaviness, restless legs, and throbbing (Figure 5). Another study on venous insufficiency reports cosmetic appearance concerns (61.9%), leg heaviness sensation (48.9%), and leg pain (62.3%) as primary issues [35]. Prolonged standing and hot seasons are reported to exacerbate pain severity, with leg cramps typically occurring at night and in the morning [36].

Chronic venous disease, affecting 5-30% of adults [37], shows a notably higher incidence of VV in nurses, nearly two times higher than that of other occupational groups and the general population, as supported by various studies. Globally, VV incidence ranges from 10% to 60%, with higher rates in Asia

compared to the Western world's 30% [38]. Studies indicate a prevalence of up to 62% in Saudi Arabia, with an annual increase of about 5% in women and 2% in men [39]. Although variations are observed across regions, the incidence of CVI in Türkiye has been determined to be 22.66%.

CONCLUSION

Older age, female gender, ≥ 2 pregnancy status, ≥ 2 number of childbirths, years in the profession, family history, and night cramps have been identified as risk factors for CVI. Among the most common comorbid diseases are hypertension, diabetes, and a history of DVT. Pregnancy has emerged as a critical period for CVI, with a significantly higher rate observed in individuals with multiple pregnancies. In those with CVI, commonly reported symptoms were leg pain, swelling, feeling of heaviness, restless legs, and throbbing. Nurses exhibit a notably higher incidence of CVI compared to other occupational groups and the general population. This underscores the occupational risk among nurses, emphasizing the necessity for preventive measures.

Ethics Committee Approval: Necessary permissions were obtained from the Institutional Review Board and Ethics Committee of Başkent University Faculty of Medicine and Health Sciences for this research (Project number: KA23/153, 23/91, Date: 26.04.2023). Subsequently, permissions were also obtained from the relevant departments of the 18 centers where the study was to be conducted.

Patient Consent for Publication: Written and verbal consent were obtained from the participating nurses.

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

Author Contributions: All authors contributed equally to the article.

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