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Vascular pathology prevalence and presentation patterns in patients presenting with leg pain to a tertiary vascular surgery clinic: A cross-sectional observational study

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MAIN POINTS

- Nearly half (46.1%) of patients presenting with leg pain at a tertiary vascular surgery clinic had no vascular disease.
- The vast majority of patients (92.8%) bypassed primary care referral systems and presented directly to the tertiary clinic.
- CVI was the predominant vascular disease (46.7%), while peripheral artery disease was less common (7.9%).
- Simple physical examination findings (pulse loss, cold extremities, edema) were highly discriminatory in identifying vascular disease (all p<0.05).
- In this clinic-based cohort from a region with limited specialist availability, the high rate of direct presentations without referral suggests opportunities for improved primary care screening.

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ABSTRACT

Aim: Lower extremity pain is a common complaint with diverse etiologies. This study aimed to determine the prevalence of vascular pathology among patients presenting with leg pain to a tertiary vascular surgery clinic and to evaluate patterns of presentation in a resource-limited region.

Materials and Methods: This cross-sectional observational study included 152 consecutive patients aged ≥18 years who presented with primary complaint of leg pain to the Cardiovascular Surgery outpatient clinic. All patients underwent bilateral arterial and venous Doppler ultrasonography. Vascular pathology was defined as the presence of peripheral artery disease (PAD) and/or chronic venous insufficiency (CVI). Referral status, clinical characteristics, and physical examination findings were recorded.

Results: Vascular pathology was identified in 82 patients (53.9%; 95% CI: 46.0-61.7), with CVI predominant (46.7%; 95% CI: 39.0-54.6) and peripheral artery disease less common (7.9%; 95% CI: 4.6-13.3). Notably, 70 patients (46.1%) had no vascular disease. The majority of patients (92.8%) presented directly without referral from primary care. Patients with vascular pathology were significantly older (45.3±15.0 vs. 36.7±13.9 years, p<0.001), had higher body mass index (27.5±4.5 vs. 25.8±4.0 kg/m², p=0.008), and exhibited higher rates of diabetes mellitus (20.7% vs. 7.1%, p=0.032) and hypertension (20.7% vs. 5.7%, p=0.015). Physical examination findings, including pulse loss, cold extremity, and edema, were significantly more common in patients with vascular pathology (all p<0.05). Multivariable analysis revealed that none of the cardiovascular risk factors remained independently associated with vascular pathology after adjustment.

Conclusion: Nearly half of patients presenting with leg pain at a tertiary vascular surgery clinic lack vascular pathology, and the vast majority bypass primary care referral systems. These findings highlight that a substantial proportion of tertiary vascular surgery consultations may be manageable at the primary care level, suggesting a potential benefit from strengthening primary care screening capacity and developing clinical pathways to guide appropriate referrals.

Keywords: Leg pain, Peripheral artery disease, Chronic venous insufficiency, Referral and consultation, Ultrasonography, Doppler

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INTRODUCTION

Lower extremity pain is a common presenting complaint that significantly impairs quality of life and places a substantial burden on healthcare systems. Vascular diseases such as peripheral artery disease (PAD) and chronic venous insufficiency (CVI) represent major etiologic factors, while musculoskeletal disorders and neurologic conditions constitute other important causes. Current epidemiologic data indicate that more than 200 million people worldwide are affected by PAD [1]. However, the clinical presentation is highly variable;

only 10-30% of patients exhibit classic intermittent claudication, while 30-60% report no exercise-related leg symptoms [2]. This heterogeneous clinical picture complicates differential diagnosis and can lead to inappropriate patient referrals.

The increasing number of patients presenting directly to tertiary vascular surgery clinics without referral from primary care has substantially increased the clinical workload. A large-scale study from Brazil found that 43% of referrals to a quaternary vascular surgery center were inappropriate, with a significant proportion consisting of venous diseases that could be managed at the primary care level [3]. Although structured referral forms and educational interventions have been shown to improve referral appropriateness, the success of these strategies is context-specific [4].

CVI affects 53% to 84% of the general population, with a substantial portion presenting at early stages (CEAP C0-C1) that can be effectively managed with conservative treatment in primary care settings [5,6].

Regional disparities are an important factor in healthcare delivery. In resource-limited regions such as southeastern Anatolia, imbalances in specialist distribution directly impact patient access to appropriate care and increase the workload of available specialists. Given the importance of early diagnosis and risk factor modification in PAD, strengthening primary care services and establishing effective referral systems has become essential [7].

This study aimed to determine the prevalence of vascular pathology and to characterize presentation patterns among patients with leg pain at a tertiary vascular surgery clinic in a resource-limited region, with the goal of informing strategies for healthcare optimization.

MATERIALS AND METHODS

Study design and population

This cross-sectional observational study was designed to evaluate patients presenting with leg pain at the Cardiovascular Surgery outpatient clinic of Batman Training and Research Hospital. The study was conducted between December 1, 2024, and March 1, 2025 and enrolled patients aged 18 years and older who met the inclusion criteria.

The study was conducted in accordance with the latest version of the Declaration of Helsinki (2013), the International Conference on Harmonisation Good Clinical Practice (ICH-GCP) guidelines, and current national regulations. All participants received detailed information regarding the study objectives, methods, expected benefits, and potential risks and provided written informed consent. The study protocol was approved by the Clinical Research Ethics Committee of Batman Training and Research Hospital (Decision no: 394, Date: 18.12.2024).

Study universe and sample selection

The study population consisted of all adult patients presenting with leg pain to the Cardiovascular Surgery outpatient clinic at Batman Training and Research Hospital. Patients who met the inclusion criteria and did not meet any exclusion criteria were enrolled using consecutive sampling. The sample size was estimated based on the pragmatic assumption that approximately one-third of patients presenting to a tertiary vascular surgery clinic with lower-extremity pain would have detectable vascular pathology. The minimum sample size was calculated to be 350 patients, using a 95% confidence level and a 5% margin of error. This parameter was adopted at the design stage to support the planning of descriptive analyses rather than to provide a definitive estimate of prevalence.

During the study period, 152 patients who met the inclusion criteria were enrolled by consecutive sampling. The target sample size of 350 patients was not achieved, primarily because the study duration was limited to three months and patient presentations were reduced during the winter months owing to regional characteristics. Although this constitutes a methodological limitation, we employed Wilson score confidence intervals to provide reliable prevalence estimates given the available sample. The observed vascular disease prevalence was 53.9% (Wilson 95% CI: 46.0-61.7%), with a margin of error of ±7.9%. This approach is considered more appropriate than post-hoc power analysis for prevalence studies, as it directly quantifies the precision of our estimates rather than retrospectively justifying sample size [8].

Inclusion and exclusion criteria

Patients aged 18 years and older who presented to the Cardiovascular Surgery outpatient clinic with leg pain as their primary complaint and who signed the informed consent form were included in the study. Only individuals making their first presentation during the study period were enrolled.

Conversely, patients younger than 18 years, those with trauma-related leg pain, those with a history of lower extremity surgery within the past 6 months, and those under follow-up for peripheral artery disease (PAD) were excluded. Additionally, patients referred from the emergency department with suspected acute vascular disease, those who could not be evaluated due to cognitive impairment, and individuals who declined participation were excluded from the study.

Data source, collection, and management

Study data were obtained through primary data collection using standardized data forms. The research team collected data through face-to-face interviews and physical examinations. All data were initially recorded on printed forms and subsequently transferred to an electronic database using double data entry. Patient data were stored electronically using only codes, with personal identifying information removed.

Variables and measurement methods

Demographic data included age, sex, body mass index (BMI), occupation, education level, and residential area (city center/district/rural). BMI was calculated from height (m) and

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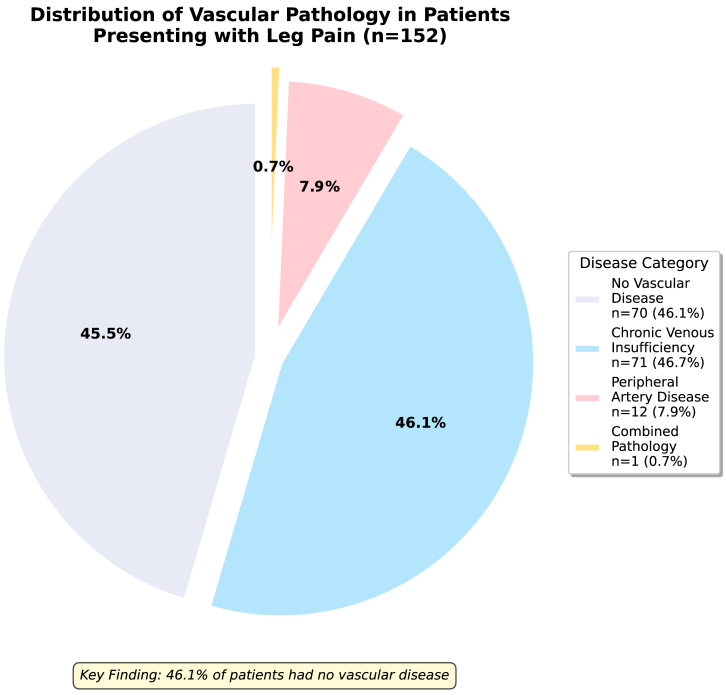

Figure 1. Distribution of vascular pathology detected by Doppler ultrasonography in patients presenting with leg pain (n=152). Chronic venous insufficiency and no vascular disease each affected approximately half of patients, while peripheral artery disease was considerably less common.

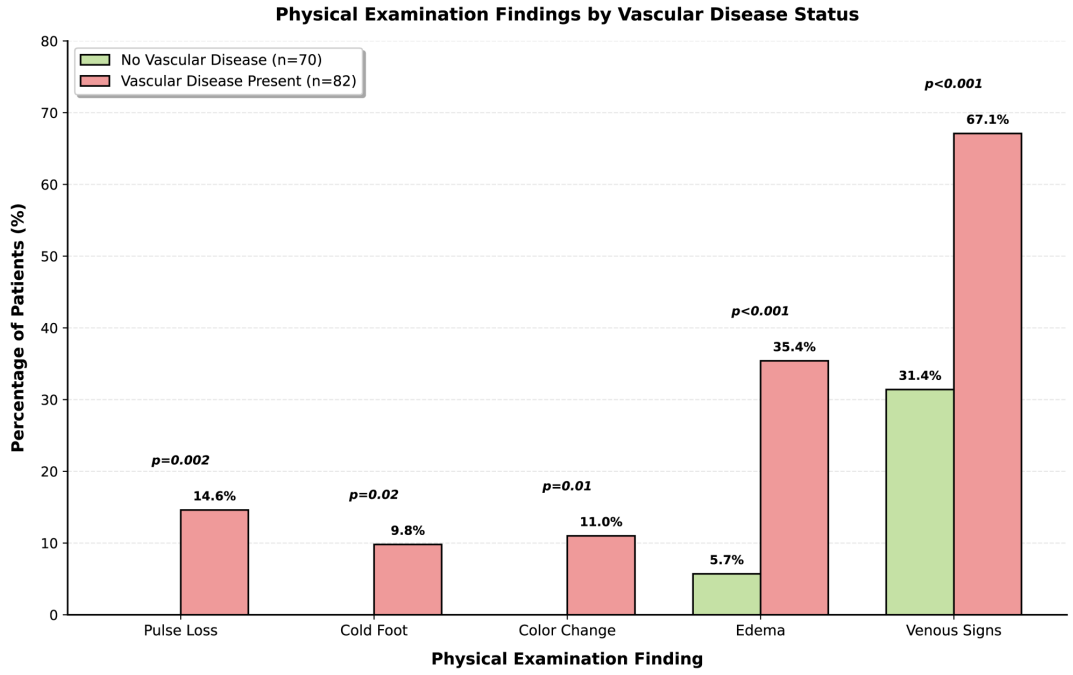

Figure 2. Comparison of physical examination findings between patients with and without vascular disease. Pulse loss, cold foot, and color change were absent in patients without vascular disease. Edema and venous signs showed significant differences between groups (all p<0.05).

weight (kg) measurements obtained using calibrated scales and a stadiometer.

Patient presentation mode (direct presentation or referral from primary care or other clinics) was recorded through patient statement and query of the hospital registration system. Direct presentation was defined as a patient presenting to the clinic of their own accord without a referral document from any healthcare facility. A referred presentation was recorded when patients arrived with official referral documents from family medicine units, other outpatient clinics, or healthcare facilities.

Risk factors assessed included smoking (never smoked, for-

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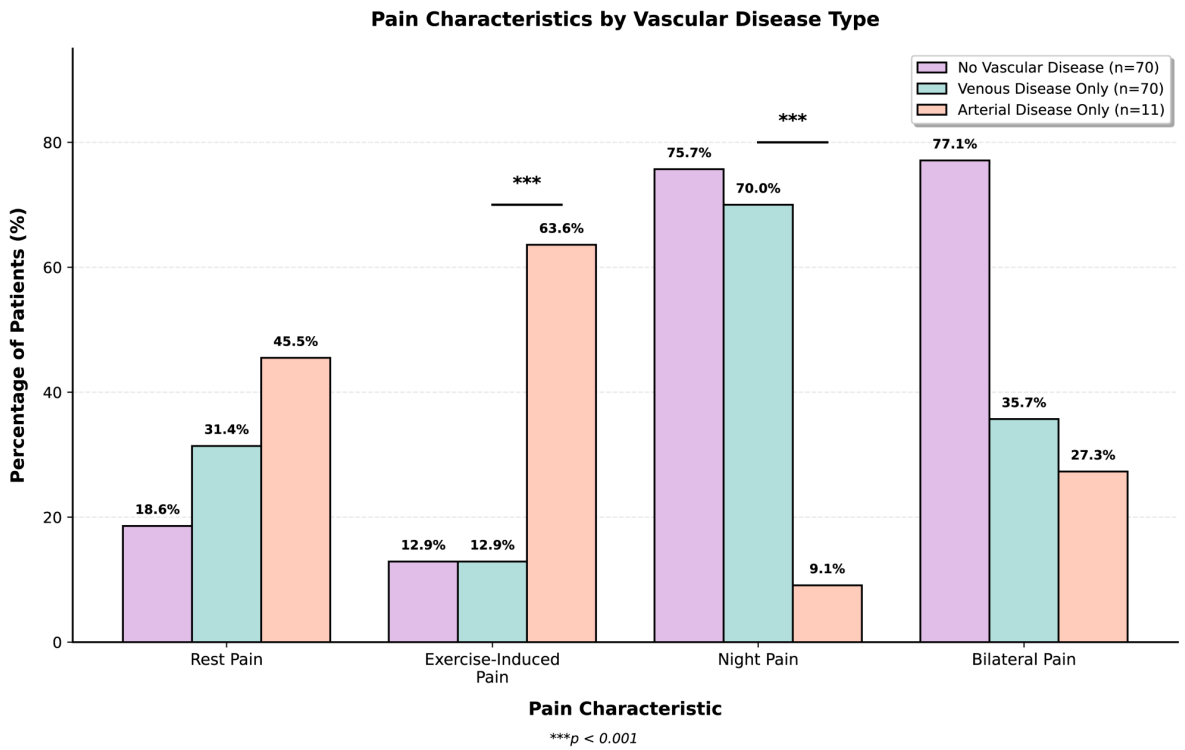

Figure 3. Pain characteristics stratified by vascular disease type. Exercise-induced pain was significantly more common in arterial disease (p<0.001), while night pain predominated in venous disease (p<0.001). Bilateral pain was more prevalent in patients without vascular disease (p<0.001). ***p<0.001.

mer smoker, active smoker, and pack-years), diabetes mellitus (fasting blood glucose ≥126 mg/dL, HbA1c ≥6.5%, or antidiabetic medication use), hypertension (systolic blood pressure ≥140 mmHg, diastolic blood pressure ≥90 mmHg, or antihypertensive medication use), coronary artery disease (previous diagnosis or revascularization history), and history of thrombosis.

Clinical evaluation included the medical history, including the duration of complaint (months), pain character (rest/exercise/night), claudication distance (meters), associated symptoms, and previous treatments.

Physical examination assessed peripheral pulses (0: not palpable, 1: weak, 2: normal, 3: strong), skin changes (temperature, color, trophic changes), presence of edema (0: absent, 1: mild, 2: moderate, 3: severe), presence of varicose veins, neurologic findings, and musculoskeletal findings.

Diagnostic protocols

All patients underwent bilateral lower extremity arterial and venous Doppler ultrasonography as a standard procedure. Doppler ultrasonography examinations were performed by radiology specialists with at least 5 years' experience, using high-resolution color Doppler ultrasonography equipment.

Arterial Doppler ultrasonography evaluated flow patterns in the femoral, popliteal, tibialis anterior, tibialis posterior, and dorsalis pedis arteries. Peripheral artery disease was diagnosed in the presence of arterial stenosis (≥50% stenosis), occlusion, or abnormal flow pattern (monophasic or absent).

Venous Doppler ultrasonography evaluated the great saphenous vein, small saphenous vein, deep venous system (femoral, popliteal, and tibial veins), and perforating veins for diameter, compressibility, flow direction, and presence of reflux. CVI was diagnosed in the presence of any of the following: venous reflux >0.5 seconds, valvular insufficiency, varicose veins, venous dilation, or sequelae of deep vein thrombosis.

Presence of vascular disease was defined as the detection of PAD on arterial Doppler ultrasonography and/or CVI on venous Doppler ultrasonography. Patients with normal findings on both examinations were classified in the "no vascular disease" group.

Statistical analysis

All statistical analyses were performed using Jamovi (Version 2.6.44, The Jamovi Project, 2023, https://www.jamovi.org) and JASP (Version 0.19.3, Jeffreys' Amazing Statistics Program, 2024, https://jasp-stats.org). Statistical significance was set at $p \leq 0.05$. Continuous variables were assessed for normality using the Kolmogorov-Smirnov test. Variables with normal distribution were expressed as mean ± standard deviation, while non-normally distributed variables were expressed as median [Minimum-Maximum]. Categorical variables were reported as frequencies (percentages). The prevalence of vascular disease and its subtypes was calculated with 95% confidence intervals using the Wilson score method. Comparisons between patients with and without vascular dis-

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ease were performed using Student's t-test for normally distributed continuous variables and the Mann-Whitney U test for non-normally distributed continuous variables. Categorical variables were compared using Pearson's chi-square test; Fisher's exact test was used when more than 20% of expected cell frequencies were less than 5. Relationships between pain characteristics and the presence of vascular disease, and comparisons of pain patterns between arterial and venous disease, were examined using chi-square or Fisher's exact tests, depending on expected cell frequencies.

Univariable binary logistic regression was performed for each potential risk factor to identify independent predictors of vascular pathology. Variables with $p<0.20$ in univariable analysis were entered into a multivariable logistic regression model using the enter method. Multicollinearity was assessed using the variance inflation factor (VIF), with VIF > 5 indicating problematic collinearity. Model fit was evaluated using the Hosmer-Lemeshow goodness-of-fit test, with $p>0.05$ indicating an adequate fit. Discriminative ability was assessed by the area under the receiver operating characteristic curve (AUC). Results were expressed as odds ratios (ORs) with 95% confidence intervals (CIs).

RESULTS

Baseline characteristics and study population

The study cohort comprised 152 patients presenting with leg pain (Table 1). Mean age was 41.3 ± 15.1 years, with a female predominance (67.8%). Most patients (80.3%) resided in urban areas , and education levels were distributed across all categories. Among cardiovascular risk factors, smoking was the most prevalent (37.5%), followed by diabetes mellitus (14.5%) and hypertension (13.8%). The median duration of complaints was 6 months (range, 0–120). Night pain was the most frequently reported symptom (68.4%), while rest pain and exercise-induced pain affected 26.3% and 16.4% of patients, respectively. More than half (54.6%) experienced bilateral lower extremity pain, and the vast majority (92.8%) presented directly without referral.

Table 1. Baseline demographic and clinical characteristics of patients presenting with lower extremity pain.

Variables	Total Cohort (n=152)
Age (years)	41.3 ± 15.1
Gender	
Male	49 (32.2%)
Female	103 (67.8%)
Height (cm)	168.6 ± 9.3
Weight (kg)	75.8 ± 12.5
Body Mass Index (kg/m²)	26.7 ± 4.3
Education Level	
Illiterate/Primary school	26 (17.1%)
Middle school	45 (29.6%)
High school	16 (10.5%)
Vocational school	43 (28.3%)
University	22 (14.5%)
Residential Area	
City center	122 (80.3%)
District	20 (13.2%)
Rural	10 (6.6%)
Risk Factors	
Smoking, present	57 (37.5%)
Diabetes mellitus, present	22 (14.5%)
Hypertension, present	21 (13.8%)
Coronary artery disease, present	13 (8.6%)
History of thrombosis, present	10 (6.6%)
Duration of Complaint (months)	6 [0-120]
Pain Characteristics	
Rest pain, present	40 (26.3%)
Exercise-induced pain, present	25 (16.4%)
Night pain, present	104 (68.4%)
Pain Location	
Right lower extremity	32 (21.1%)
Left lower extremity	37 (24.3%)
Bilateral	83 (54.6%)
Referral Status	
Direct admission	141 (92.8%)
Referred	11 (7.2%)

Continuous variables are presented as mean ± SD or median [Minimum- Maximum]. Categorical variables are presented as n (%). Vocational school includes vocational high schools and two-year post-secondary vocational colleges in the Turkish educational system. Abbreviations: SD, standard deviation.

Vascular disease prevalence

Doppler ultrasonography detected vascular disease in 82 patients (53.9%; 95% CI: 46.0-61.7) (Table 2, Figure 1). CVI was the predominant finding, affecting 71 patients (46.7%; 95% CI: 39.0-54.6). Peripheral artery disease was considerably less common; it was identified in 12 patients (7.9%; 95% CI: 4.6-13.3). Combined arterial and venous disease was present in only one patient (0.7%). Both Doppler examinations were normal in 70 patients (46.1%), indicating a substantial proportion of non-vascular etiologies (Figure 1).

Comparison according to vascular disease presence

Patients with vascular disease were significantly older than those without (45.3 ± 15.0 vs. 36.7 ± 13.9 years; $p<0.001$) and had higher body mass index (27.5 ± 4.5 vs. 25.8 ± 4.0 kg/m²; $p = 0.008$) (Table 3). Sex distribution and residential area showed no significant associations ($p = 0.47$ and $p>0.99$, respectively). Diabetes mellitus (20.7% vs. 7.1%; $p = 0.03$), hypertension (20.7% vs. 5.7%; $p = 0.015$), and history of thrombosis (11.0% vs. 1.4%; $p = 0.04$) were significantly more prevalent in patients with vascular disease. There were no significant differences in smoking and coronary artery disease ($p = 0.93$ and $p = 0.15$, respectively).

None of the pain characteristics reached statistical significance between groups, although rest pain showed a trend toward a higher prevalence in patients with vascular disease (32.9% vs. 18.6%; $p = 0.069$) (Figure 2). Physical examination findings were highly discriminative. Notably, pulse loss, cold foot, and color change were absent in patients without vascular disease, were present in 14.6% ($p = 0.002$), 9.8% ($p =$

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Table 2. Distribution of vascular pathology detected by doppler ultrasonography.

Diagnostic Category	n	%	95% CI
Arterial Pathology			
Peripheral artery disease	12	7.9	4.6-13.3
Venous Pathology			
Chronic venous insufficiency (CVI)	71	46.7	39.0-54.6
Combined Pathology			
Both arterial and venous	1	0.7	0.1-3.6
No Vascular Pathology			
Both Doppler studies normal	70	46.1	38.3-54.0
Total Vascular Pathology			
At least one Doppler positive	82	53.9	46.0-61.7

Abbreviations: CI, confidence interval.

0.02), and 11.0% (p = 0.01) of those with vascular disease, respectively. Edema (35.4% vs. 5.7%; p<0.001) and venous signs (67.1% vs. 31.4%; p<0.001) were substantially more common in the vascular disease group (Figure 2).

Pain characteristics and vascular disease type

Pain characteristics differed across disease types (Table 4, Figure 3). Bilateral pain was significantly more prevalent in patients without vascular disease (77.1% vs. 35.4%; p<0.001). Comparison of arterial and venous disease revealed striking differences: exercise-induced pain was markedly more common in arterial disease (63.6% vs. 12.9%; p<0.001), whereas night pain was significantly more prevalent in venous disease (70.0% vs. 9.1%; p<0.001) (Figure 3). Rest pain, bilateral pain distribution, and chronic pain duration showed no significant differences between disease types.

Predictors of vascular pathology

Univariable logistic regression analysis identified age (OR: 1.04; 95% CI: 1.02–1.07; p < 0.001), BMI (OR: 1.11; 95% CI: 1.02–1.20; p = 0.013), diabetes mellitus (OR: 3.40; 95% CI: 1.18–9.76; p = 0.023), hypertension (OR: 4.32; 95% CI: 1.38–13.52; p = 0.012), and history of thrombosis (OR: 8.51; 95% CI: 1.05–68.92; p = 0.045) as significant predictors of vascular pathology (Table 5). Coronary artery disease showed a trend toward statistical significance (OR: 3.10; 95% CI: 0.82–11.76; p = 0.096). In multivariable analysis adjusting for age, BMI, diabetes mellitus, hypertension, and coronary artery disease, none of the cardiovascular risk factors remained independently associated with vascular pathology. The multivariable model demonstrated acceptable discrimination (AUC = 0.697) and adequate calibration (Hosmer-Lemeshow p = 0.675).

DISCUSSION

In our study, nearly half (46.1%) of patients presenting to our tertiary vascular surgery outpatient clinic with primary complaints of leg pain had no vascular disease. Moreover, the vast majority of patients (92.8%) presented directly to our clinic without any referral from primary care services. These findings suggest that, in our region, patients frequently bypass the referral system, where specialist availability is limited, potentially increasing specialists' workload with cases that might be managed at the primary care level.

Our results , consistent with the literature, reveal the complexity of the differential diagnosis of leg pain and the prevalence of vascular diseases in this clinic-based population. McDermott's comprehensive review emphasized that 30% to 60% of patients with peripheral artery disease in primary care settings exhibit no exercise-related leg symptoms, and 45% to 50% report atypical complaints that do not meet classic intermittent claudication criteria [2]. This demonstrates that even vascular diseases can present with heterogeneous clinical presentations; therefore, not every patient with leg pain has a vascular etiology.

CVI was present in 46.7% patients with detected vascular disease in our study. The prevalence of CVI ranges from 53% to 84% in European studies, although a substantial portion consists of mild forms and telangiectasias [5,9]. In Turkey, a study of patients presenting with lumbar spinal disease reported CVI prevalence of 53.1%, with early-stage disease (78.6% C0-1) being predominant [10]. In our cohort, the rate of symptomatic venous insufficiency was higher than reported in the literature, which can be explained by patients actively presenting with symptoms. However, most cases of venous insufficiency can be managed at the primary care level with conservative treatment and compression. In our study, body mass index was significantly higher in patients with vascular disease (27.5±4.5 vs. 25.8±4.0 kg/m^2, p=0.008). Popplewell et al.'s study in obese patients in the United Kingdom found that while 25% of patients attending weight management services had a diagnosis of lower extremity venous disease, 82% had symptoms related to venous disease [11]. Notably, 69% of patients were unaware of the association between obesity and venous disease [11]. This may explain the high rate of direct presentation (92.8%) and the burden of undiagnosed disease in our study.

Our prevalence of peripheral artery disease (7.9%) is consistent with global estimates reported in the literature. Song and colleagues' 2019 systematic review reported that PAD affects 238 million people worldwide and that prevalence increases with age [12]. In our cohort, diabetes mellitus (20.7% vs. 7.1%, p=0.032) and hypertension (20.7% vs. 5.7%, p=0.015) were significantly more common in patients with detected PAD, consistent with established risk factors. However, strikingly even among patients with PAD, only 63.6% reported exercise-related pain; this observation should be interpreted cautiously given the small subgroup size (n=12). Nevertheless, this finding is consistent with studies showing that classic intermittent claudication is not the most frequent presentation of PAD [2,7].

International studies evaluating the effectiveness of referral

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Table 3. Clinical and physical examination findings according to vascular pathology status.

Variables	No Vascular Pathology (n=70)	Vascular Pathology Present (n=82)	p value
Demographic Characteristics			
Age (years)	36.7 ± 13.9	45.3 ± 15.0	**<0.001**
Gender (Female)	50 (71.4%)	53 (64.6%)	0.472
Body Mass Index (kg/m²)	25.8 ± 4.0	27.5 ± 4.5	**0.008**
Education (Illiterate/Primary school)	7 (10.0%)	19 (23.2%)	0.053
Residential Area (City center)	56 (80.0%)	66 (80.5%)	0.999
Risk Factors			
Smoking, present	27 (38.6%)	30 (36.6%)	0.933
Diabetes mellitus, present	5 (7.1%)	17 (20.7%)	**0.032**
Hypertension, present	4 (5.7%)	17 (20.7%)	**0.015**
Coronary artery disease, present	3 (4.3%)	10 (12.2%)	0.148
History of thrombosis, present	1 (1.4%)	9 (11.0%)	**0.042**
Clinical Characteristics			
Duration of complaint (months)	6 [0-60]	7 [1-120]	0.161
Pain Characteristics			
Rest pain, present	13 (18.6%)	27 (32.9%)	0.069
Exercise-induced pain, present	9 (12.9%)	16 (19.5%)	0.377
Night pain, present	53 (75.7%)	51 (62.2%)	0.107
Physical Examination Findings			
Any pulse loss, present	0 (0.0%)	12 (14.6%)	**0.002**
Cold foot, present	0 (0.0%)	8 (9.8%)	**0.020**
Color change, present	0 (0.0%)	9 (11.0%)	**0.012**
Edema, present	4 (5.7%)	29 (35.4%)	**<0.001**
Venous signs, present	22 (31.4%)	55 (67.1%)	**<0.001**

Bold p-values indicate statistical significance ($p \leq 0.05$). Student t-test or Mann-Whitney U test for continuous variables; Chi-square or Fisher's exact test for categorical variables. Abbreviations: SD, standard deviation.

Table 4. Pain characteristics stratified by pathology type: arterial versus venous disease.

Pain Characteristics	No Pathology (n=70)	Vascular Pathology Present (n=82)	p value†	Arterial Only (n=11)	Venous Only (n=70)	p value‡
Rest pain, present	13 (18.6%)	27 (32.9%)	0.069	5 (45.5%)	22 (31.4%)	0.566
Exercise-induced pain, present	9 (12.9%)	16 (19.5%)	0.377	7 (63.6%)	9 (12.9%)	<0.001
Night pain, present	53 (75.7%)	51 (62.2%)	0.107	1 (9.1%)	49 (70.0%)	<0.001
Bilateral pain, present	54 (77.1%)	29 (35.4%)	<0.001	3 (27.3%)	25 (35.7%)	0.837
Chronic pain (≥12 months), present	28 (40.0%)	39 (47.6%)	0.440	4 (36.4%)	34 (48.6%)	0.668

Bold p-values indicate statistical significance ($p \leq 0.05$). † Comparison between vascular pathology present vs absent (Chi-square or Fisher's exact test). ‡ Comparison between arterial only vs venous only pathology (Chi-square or Fisher's exact test).

Table 5. Univariable and multivariable logistic regression analysis for predictors of vascular pathology in patients presenting with leg pain.

Independent Variables	Univariable OR [95% CI]	p	Multivariable OR [95% CI]	p
Age, per 1-year increase	1.04 [1.02–1.07]	**<0.001**	1.03 [1.00–1.06]	0.072
BMI, per 1 kg/m² increase	1.11 [1.02–1.20]	**0.013**	1.03 [0.93–1.13]	0.604
Diabetes mellitus, present vs absent	3.40 [1.18–9.76]	**0.023**	1.49 [0.44–5.02]	0.521
Hypertension, present vs absent	4.32 [1.38–13.52]	**0.012**	1.88 [0.51–6.96]	0.341
Coronary artery disease, present vs absent	3.10 [0.82–11.76]	0.096	1.09 [0.23–5.10]	0.916

Model summary: −2 Log Likelihood = 193.85; Nagelkerke $R^2 = 0.133$; AUC = 0.697 (95% CI: 0.614–0.780); Hosmer-Lemeshow $\chi^2 = 5.75$, p = 0.675. Bold p-values indicate statistical significance ($p \leq 0.05$). Multivariable analysis included all variables with $p<0.20$ in univariable analysis using the enter method. The dependent variable was vascular pathology presence (peripheral artery disease and/or chronic venous insufficiency) confirmed by Doppler ultrasonography. Abbreviations: OR, odds ratio; CI, confidence interval; BMI, body mass index; AUC, area under the receiver operating characteristic curve.

systems support our findings. In Brazil, Portela and colleagues evaluated 1,203 referrals to a quaternary vascular surgery center and found 43% of referrals to be inappropriate [3]. While venous disease was the most common referral indication (53%), only 39.92% of patients underwent surgical treatment. The authors suggested that these inappropriate referrals lead to underutilization of high-complexity services and that telemedicine could reduce this rate. A sys-

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tematic review from the United Kingdom demonstrated that structured referral forms, peer feedback, and educational interventions involving specialists improved referral appropriateness [4]. However, the success of such interventions is context-specific, and information regarding implementation challenges remains limited.

In our study, 54.6% of patients without vascular disease had bilateral leg pain. Bilateral pain was significantly less frequent in venous disease (35.7%) and in arterial disease (27.3%) ($p<0.001$). These findings suggest that bilateral leg pain is more likely to be associated with musculoskeletal, neurologic, or systemic causes than with a vascular etiology. In Mendoza's review addressing differential diagnosis of leg pain in phlebology practice, it was emphasized that leg pain often does not originate from varicose veins or venous disease, and that incidental varicose veins are found in 90% of the population [13]. This suggests that a significant proportion of our patients may have been referred for vascular surgery due to misperception.

In the context of our region's healthcare system, these clinic-based findings carry practical implications for local service planning. In the Southeastern Anatolia Region, the number of specialists, particularly in critical specialties such as vascular surgery, is lower than the national average. According to data from the Ministry of Health, the number of vascular surgery specialists per 100,000 population in our region is approximately 40% lower than the national average. In our clinical experience, a substantial proportion of specialist consultations involved patients who could be managed at the primary care level. Particularly, 46.1% of patients without detected vascular disease could be managed at the family medicine level through appropriate examination and evaluation.

In our study, we found that physical examination findings (pulse loss, cold foot, color change, edema, and venous signs) were significantly more common in patients with vascular disease (all $p<0.05$). These findings demonstrate that even a simple physical examination can be quite effective in predicting the presence of vascular disease. Multivariable analysis revealed that traditional cardiovascular risk factors lost their predictive significance after mutual adjustment, suggesting substantial shared variance among these correlated variables. This finding indicates that risk factor inquiry alone cannot reliably identify vascular pathology in patients presenting with leg pain. Rather, clinical examination findings—particularly pulse assessment, skin changes, and edema—should guide referral decisions at the primary care level. These observations suggest that future efforts to strengthen basic vascular examination skills among primary care physicians and to develop standardized evaluation protocols warrant investigation as potential strategies to optimize referral patterns.

Strengthening family medicine services and improving care coordination may help optimize patient flow to appropriate levels of care, although the specific barriers to primary care utilization in our population require further investigation. Health literacy initiatives informing patients that not every leg pain requires specialist evaluation may be beneficial, though the effectiveness of such interventions in our setting remains to be determined. Future studies should evaluate whether targeted educational programs for family physicians that focus on the clinical differentiation of vascular and non-vascular leg pain could improve the appropriateness of referrals. Our findings may contribute to improving resource utilization in regions with imbalanced specialist distribution and may support the development of evidence-based referral algorithms.

Our study has several limitations. First, the target sample size of 350 patients was not achieved; only 152 patients (43% of the target) were enrolled due to the predefined three-month study duration and reduced patient presentations during the winter months. This represents a significant methodological limitation, resulting in a margin of error of ±7.9% rather than the planned ±5% for our prevalence estimates, which reduces precision and limits statistical power for subgroup analyses. However, we employed Wilson score confidence intervals to quantify the uncertainty of our estimates appropriately, rather than conducting post-hoc power analysis. Second, our cross-sectional design captures associations at a single time point; causal relationships cannot be inferred, and we cannot evaluate factors influencing patient referral decisions over time. Third, the generalizability of our findings is limited because the study was conducted at a single center and included patients from the Southeastern Anatolia region; however, this limitation also provides value by revealing regional healthcare patterns. Fourth, and critically, we did not systematically assess why patients chose to present directly to the tertiary clinic rather than seeking primary care evaluation first. This represents a missed opportunity, as understanding patient motivations is essential for designing effective interventions to optimize referral pathways. Potential factors—including transportation difficulties, perceived access barriers, trust in the family medicine system, appointment availability, health literacy, and symptom severity concerns—remain speculative without a formal qualitative assessment. Future studies should evaluate these factors using structured questionnaires and include primary care physicians to ascertain reasons for referral. Finally, a significant limitation is that we did not systematically record subsequent diagnoses for the 70 patients (46.1%) without vascular pathology; consequently, data on actual etiologies (e.g., musculoskeletal, neurological) and clinical outcomes were not collected. Additionally, CEAP clinical severity classification was not recorded for patients with CVI, precluding determination of the proportion of patients with early-stage (C0–C2) versus advanced (C3–C6) disease.

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