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ORIGINAL RESEARCH

Examining Psychological Factors in Peripheral Artery Disease: Affective Temperament, Anxiety, and Depression in Patients Undergoing Revascularization Procedures

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Purpose: This study aimed to assess the prevalence of depressive and anxiety symptoms in peripheral artery disease (PAD) patients, correlating these symptoms with clinical parameters and examining affective temperaments within the study group.

Material and Methods: A total of 159 PAD patients, predominantly male, admitted for vascular surgery due to lower limb atherosclerosis, participated in this cross-sectional study. Various assessments were conducted, including the Temperament Evaluation of Memphis, Pisa, Paris, and San Diego-Autoquestionnaire (TEMPS-A) for affective temperaments, the Hospital Anxiety and Depression Scale (HADS) for anxiety and depression symptoms, and the Numerical Rating Scale (NRS) for pain intensity. Additionally, the Ankle-Brachial Index (ABI) was measured to assess circulation in the legs.

Results: The findings revealed a higher prevalence of depressive and anxiety symptoms in the PAD patient group compared to the control group. Notably, depressive and anxiety symptoms correlated with the severity of PAD, as indicated by lower ABI values in the operated leg. Patients undergoing surgical revascularizations exhibited higher depressive symptoms than those undergoing endovascular procedures. Furthermore, correlations were observed between depressive symptoms and the number of previous vascular procedures and amputations, alongside increased pain levels at admission. Clinical factors such as diabetes, hypertension, heart failure, ischemic heart disease, previous revascularization procedures, amputations, and the intensity of affective temperaments did not correlate with HADS scores.

Discussion: The study highlighted the intricate relationship between mood disorders and PAD severity, emphasizing the potential prognostic implications of untreated depression and anxiety in PAD patients. These findings suggest the importance of closely monitoring and addressing psychological well-being in PAD management. However, the study encountered limitations such as varying assessment timing and sample size discrepancies among comorbidities, impacting the observation of associations between mood disorders and certain conditions.

Conclusion: In conclusion, depressive and anxiety symptoms are often in PAD. Further research is needed to explore therapeutic interventions targeting mental health and pain management to improve the course and outcomes of PAD.

Keywords: c*hronic limb* ischaemia, mood disorders, affective temperament, behavioral profiles, pain

Introduction

Peripheral artery disease (PAD) stands as one of the most prevalent cardiovascular diseases (CVDs). Its pathogenesis involves atherosclerotic narrowing of arteries, leading to inadequate blood flow and subsequent ischemia. Diagnosis of PAD typically relies on clinical symptoms and a reduced ankle-brachial index (ABI). Notably, ABI serves multiple roles,

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including predicting total and cardiovascular mortality, major coronary or limb events, and wound healing.[1] The course of PAD is diverse, influenced by several factors like smoking, blood pressure, cholesterol levels, diabetes control, and physical activity. In addition, PAD often coexist with other manifestations of atherosclerosis.[2] Growing evidence suggests the involvement of psychological factors in PAD, echoing their impact on other CVDs.

Depression and anxiety represent prevalent mental health disorders, commonly associated with CVDs.[3,4] While there are reports specifically addressing PAD,[4,5] they lack comprehensiveness. The relationship between PAD and mood disorders is intricate and reciprocal. Shared mechanisms, such as stress axis activation, catecholaminergic, coagulation, and immune system responses, elevated homocysteine levels, and vascular endothelial lesions, create a complex interplay.[3,4,6] Additionally, depression and anxiety exacerbate other cardiovascular risk factors and reduce adherence to therapy and healthy lifestyles.[3,4] Notably, PAD predominantly affects the legs, resulting in various symptoms like intermittent claudication. Previous studies highlight the psychological component in pain, emphasizing that mood disorders can amplify pain experiences.[7] However, data relating depression or anxiety to PAD progression, such as ABI, type of revascularization, or previous vascular interventions, remains scarce. Considering the necessity for numerous vascular procedures or surgeries in advanced disease stages, the literature surprisingly reports similar incidences of anxiety and depression in patients with chronic limb-threatening ischemia, irrespective of revascularization type.[8] Previous studies have consistently pointed out that depressive and anxiety disorders worsen the prognosis in PAD.[5,8–10]

The affective temperament, genetically determined and stable throughout life, reflects human behavior and emotions. Comprising five detailed types - hyperthymic, depressed, irritable, cyclothymic, and anxious - these temperaments may predispose individuals to mood disorders.[11] Recent studies have unveiled connections between affective temperaments and various CVDs like coronary artery disease and hypertension. For instance, cyclothymic and irritable temperaments showed associations with significant coronary artery stenosis.[12] Moreover, cyclothymic temperament correlated with accelerated vascular aging in women,[13] while hyperthymic temperament demonstrated a protective effect against coronary artery disease.[12,14] Cyclothymic temperament also revealed an important link to hypertension,[15] left ventricular hypertrophy in hypertensive patients,[16] and cardiac complications necessitating acute hospitalization.[17] Despite reports highlighting psychological factors in CVDs, limited attention has been given to PAD. Therefore, this study aimed to assess depression and anxiety symptoms in PAD patients undergoing endovascular or surgical revascularizations and to explore their relationship with clinical parameters. Additionally, the study aimed to define affective temperaments within this group.

Materials and Methods

This cross-sectional study aimed to evaluate affective temperaments, anxiety, depressive symptoms, pain intensity, and ABI in 159 hospitalized patients undergoing surgical revascularization for PAD. The study cohort comprised predominantly male individuals admitted to the hospital for elective vascular surgery due to symptomatic atherosclerosis of the lower limbs. Of the total participants, 124 underwent endovascular surgery, and 35 underwent traditional surgical intervention. All patients received optimal medical therapy due to PAD (including statins, antiplatelet drugs). Also concomitant diseases were compensated and the pain treatment was adequate. The exclusion criteria were as follows: acute condition (also acute limb ischemia), significant neurological or psychiatric disorders and lack of consent.

For the study group, a control group consisting of 160 healthy, chronically untreated people. The control group did not differ from the study group in terms of gender ($p = 0.72$).

Assessment of Affective Temperaments

The Temperament Evaluation of Memphis, Pisa, Paris, and San Diego-Autoquestionnaire (TEMPS-A) was employed as a self-report scale to assess five affective temperamental domains related to mood disorders. Developed by Dr. Hagop Akiskal et al, this scale evaluates Cyclothymic, Dysthymic, Hyperthymic, Irritable, and Anxious temperaments. Respondents rated their agreement or frequency of experiencing mood-related traits on a scale to identify predominant temperamental traits. The TEMPS-A scale measures the following affective temperaments:

a) Cyclothymic: This dimension assesses cyclical mood changes characterized by alternating periods of hypomanic and depressive symptoms. Individuals scoring high on this dimension may experience mood swings and variability in energy levels.
b) Dysthymic: This dimension evaluates a propensity toward depressive traits, including sadness, pessimism, low energy, and a general feeling of dissatisfaction with life.
c) Hyperthymic: This dimension reflects a temperament associated with elevated, expansive, and overly positive moods. Individuals scoring high on this dimension may display high energy levels, optimism, and increased sociability.
d) Irritable: This dimension measures irritability, often present in individuals experiencing mood disorders. It reflects a tendency to react with anger, annoyance, or impatience to various stimuli or situations.
e) Anxious: This dimension assesses anxious temperament characterized by excessive worrying, nervousness, and a tendency to feel tense or apprehensive.

The comparison of TEMPS-A results in the study population was contextualized using a gender-matched control group derived from prior scale validation studies conducted in Polish conditions.[18]

Evaluation of Anxiety and Depression Symptoms

The Hospital Anxiety and Depression Scale (HADS), a self-assessment questionnaire, was utilized to measure anxiety and depression levels in patients. Developed by Zigmond and Snaith, this scale consists of Anxiety (HADS-A) and Depression (HADS-D) subscales, each containing seven items. Participants rated their experiences over the past week, enabling assessment of anxiety and depression symptoms separately.

a) Anxiety Subscale (HADS-A): This subscale focuses on assessing symptoms related to anxiety. It includes questions about feelings of tension, apprehension, panic, and restlessness over the past week. Respondents rate their experiences on a scale ranging from 0 to 3 (eg, from "not at all" to "very much so").
b) Depression Subscale (HADS-D): This subscale concentrates on evaluating symptoms associated with depression. It covers feelings of low mood, lack of enjoyment or pleasure, hopelessness, and worthlessness experienced over the past week.

Both subscales, anxiety (HADS-A) and depression (HADS-D), are scored separately. The total scores for each subscale range from 0 to 21, with higher scores indicating more severe symptoms of anxiety or depression.

Quantification of Pain Intensity

The Numerical Rating Scale (NRS) served as a measurement tool to quantify subjective experiences, primarily pain intensity, on a scale from 0 to 10. This straightforward scale allowed patients to rate their current pain level, aiding in the assessment of pain severity.

The values are typically represented as follows:
0: No pain (or no symptoms)
1–3: Mild pain (or mild symptoms)
4–6: Moderate pain (or moderate symptoms)
7–10: Severe pain (or severe symptoms)

ABI Assessment

ABI, a non-invasive test evaluating leg circulation by comparing ankle and arm blood pressure, was conducted using a Hadeco Minidop ES100VX Doppler ultrasound device. Systolic blood pressure readings from arms and ankles were used to calculate ABI for each leg, aiding in the diagnosis of PAD and risk assessment for associated complications.

Statistical Analysis

Following the evaluation of the data distribution via the Shapiro–Wilk test, it was established that the data did not adhere to a normal distribution pattern. Subsequently, non-parametric tests were applied, and the data were primarily expressed in the form of medians (with interquartile ranges Q1-Q4). To evaluate the relationships between variables, the Spearman's rank correlation test was employed. Distinctions between groups were appraised using the Mann–Whitney *U*-test. Furthermore, a comprehensive analysis was conducted utilizing a regression model in a multivariate approach. Significance levels were determined at a threshold of $p < 0.05$ to ascertain statistical significance.

Ethical Standards

Prior to their involvement, all participants were fully briefed on the objectives of the study. Participation was contingent upon the completion of an informed consent form. Approval for the study was secured from the Bioethical Commission of the NCU, Collegium Medium in Bydgoszcz (Approval No. 471/2017), ensuring adherence to the esteemed principles outlined in the Declaration of Helsinki.

Results

Demographic and clinical data in the study group are summarized in Table 1.

The initial analysis compared the intensity of affective temperaments in the study group with a gender-matched control group. Significantly higher expressions of depressive, irritable, and anxious temperaments were observed, along with a significantly lower expression of hyperthymic temperament in the study group (Table 2).

Further examination focused on differences in clinical and psychological outcomes among subgroups undergoing different revascularization procedures. It is noteworthy that nearly 30% of the participants exhibited clinically significant severity of drug-related symptoms, while over 16% displayed depressive symptoms. Notably, a significant difference was detected solely in depression symptom intensity, which was markedly higher in the subgroup of patients qualified for surgery (Table 3).

Table 1 Demographic and Clinical Data in Study Group

Parameter		All N=159	PTA (n=126)	Surgery (n=33)	p
Age, y		66,0 (59,0–73,0)	66,5 (60,0–73,0)	66,0 (59,0–70,0)	0,63
Gender (♀,♂)		52 (32,7%) / 107 (67,5%)	38 (30%) / 88 (70%)	20 (57,5%) / 14 (42,5%)	0,23
No of previous vascular treatments	Median Q25-Q75	1,0 (0,0–2,0)	1,0 (0,0–2,0)	1,0 (0,0–2,0)	0,67
No of patients with amputation		13 (8%)	10 (8%)	3 (10%)	0,31
ABI of operated limb [m]		0,50 (0225–0675)	0,5 (0,30–0,70)	0365 (0,13–0,53)	0,09
ABI of non-operated limb [m]		0,69 (0,35–0,87)	0,675 (0,35–0,90)	0695 (0,50–0,83)	0,61
DM, n		65 (41%)	51 (40,5%)	14 (42%)	0,87
HA, n		113 (71,5%)	88 (70%)	25 (76%)	0,52
CHF, n		28 (17,5%)	23 (18%)	5 (15%)	0,75
IHD, n		66 (42%)	51 (40,5%)	15 (45%)	0,63

Notes: Data are presented as medians and 25th and 75th quartiles or in number of subjects (n, %).
Abbreviations: ABI, ankle brachial-index; PTA, percutaneous transluminal angioplasty; DM, diabetes mellitus; HA, hypertension arterialis; CHF, congestive heart failure; IHD, ischemic heart disease;

Table 2 TEMPS_A Scale Results in the Study Group and the Control Group

	Study group	Control group	p
Gender (♀/♂)	52 (33%)/107 (67%)	56 (35%)/104 (65%)	0,72
TEMPS_depressive,	0,38 (0,28–0,47)	0,23 (0,19–0,38)	<0,000001
TEMPS_cyclothymic	0,28 (0,09–0,52)	0,29 (0,19–0,38)	0,25
TEMPS_hyperthymic	0,52 (0,33–0,61)	0,55 (0,35–0,67)	0011
TEMPS_irritable	0,10 (0,05–0,25)	0,20 (0,10–0,35)	0,00001
TEMPS_anxious	0,30 (0,11–0,53)	0,19 (0,11–0,34)	0,0007

Notes: Data are presented as medians and 25th and 75th quartiles or in number of subjects (n, %).
Abbreviations:TEMPS_A The Temperament Evaluation of Memphis, Pisa, Paris, and San Diego-Autoquestionnaire.

Table 3 Results of the HADS Scale in the Patient Population Divided into Subgroups

		All	PTA (n=126)	Surgery (n=33)	p
Age (y)		66,0 (59,0–73,0)	66,5 (60,0–73,0)	66,0 (59,0–70,0)	0,62
Gender (♀,♂)		52 (32,7%) / 107 (67,5%)	38 (30%) / 88 (70%)	20 (57,5%) / 14 (42,5%)	0,28
NRS przy przyjęciu		0,0 (0,0–3,0)	0,0 (0,0–3,0)	0,0 (0,0–5,0)	0,22
HADS_A result [p]		5,0 (3,0–8,0)	5,0 (3,0–8,0)	6,0 (4,0–9,0)	0,14
HADS_A [n/%]	0–7	99 (71%)	80 (72,5%)	19 (65,5%)	0,47
	8–10	27 (19,5%)	20 (18,5%)	7 (24%)	
	11–21	13 (9,5%)	10 (9%)	3 (10,5%)	
HADS_D result [p]		5,0 (2,0–7,0)	4,0 (2,0–6,0)	6,0 (4,0–8,0)	0,02
HADS_D [n/%]	0–7	116 (83,5)	97 (88,5%)	19 (65,5%)	0003
	8–10	17 (12%)	10 (9%)	7 (24%)	
	11–21	6 (4,5%)	3 (2,5%)	3 (10,5%)	

Notes: Data are presented as medians and 25th and 75th quartiles or in number of subjects (n, %).
Abbreviations: PTA, percutaneous transluminal angioplasty; NRS, numerical rating scale; HADS, Hospital Anxiety and Depression Scale; y, years; m, meters; p points.

Correlation analyses were performed to explore the relationship between anxiety, depression severity, and quantitative parameters (Table 4). Results unveiled a significant positive correlation between anxiety, depression symptoms, and the intensity of pain. Conversely, a significant negative correlation was observed between anxiety, depressive symptoms, and the ABI score of the operated limb.

Table 4 Assessment of the Correlation of HADS Scale Parameters with Clinical Factors

	All			
	HADS_A		HADS_D	
	R	p	R	P
Age [y]	−0,05	0,53	0,15	0059
No of previous vascular procedures [n]	0,08	0,31	−0,01	0,09
Time from first vascular procedure [months]	−0,02	0,80	0,05	0,53
ABI operated leg	−0,17	0,03	−0,38	0,000001
ABI nonoperated leg	0,10	0,20	−0,03	0,70
NRS ad admission	0,01	0,02	0,32	0,00004

Notes: R-Spearman correlations.
Abbreviations: ABI, Ankle-Brachial Index; NRS, numerical rating scale; HADS, Hospital Anxiety and Depression Scale.

Table 5 Assessment of Correlation of TEMPS Scale Parameters with HADS Scale Results

	HADS_A		HADS_D	
	R	p	R	P
TEMPS_depressive,	0,13	0,1	0,12	0,13
TEMPS_cyclothymic	0,14	0,08	−0,09	0,25
TEMPS_hyperthymic	0,11	0,16	−0,01	0,90
TEMPS_irritable	−0,03	0,70	−0,04	0,61
TEMPS_anxious	−0,01	0,90	−0,02	0,80

Notes: R-Spearman correlations.
Abbreviations: TEMPS_A The Temperament Evaluation of Memphis, Pisa, Paris, and San Diego-Autoquestionnaire; HADS_A.Hospital Anxiety and Depression Scale – anxiety scale; HADS_D, Hospital Anxiety and Depression Scale – depression scale.

Interestingly, no significant correlations were found between the intensity of affective temperaments and the HADS results (Table 5).

Multivariate analysis was conducted to identify factors influencing anxiety and depressive symptoms (Table 6). The analysis revealed that only amputations significantly impacted anxiety severity. For depressive symptoms, significant factors included previous revascularization procedures, previous amputations, and the severity of pain upon admission to the hospital. Clinical factors such as diabetes, hypertension, heart failure, ischemic heart disease, previous revascularization procedures, and amputations did not exhibit significant associations with HADS scores.

Discussion

In the contemporary landscape of medical research, the intricate interplay between somatic diseases and psychological facets has garnered increasing attention. The association between atherosclerotic diseases, including PAD, and mood

Table 6 Multivariate Analysis – Regression Model for HADS Results

	HADS A				HADS D			
	Value of model	p	β	CI [95% CI] –95%	Value of model	P	β	CI [95% CI] –95%
Age	6,48	0,16	−0,11	−0,19/0,08	−0,04	0,36	−0,11	−0,14/0,05
Gender	0,49	0,40	0,12	−0,68–1,66	1,02	0,09	0,32	0,18/1,8
Type of intervention	−0,48	0,45	−0,10	−1,75/0,81	−0,24	0,60	−0,06	−1,1/0,68
Previous interventions 1/0	−0,21	0,51	0,02	−0,21/0,29	0,11	0,68	0,03	−0,44/0,66
No of previous vascular treatments	0,13	0,68	0,06	−0,55/0,82	0,65	0,01	0,29	0,16/1,1
Amputation	4,1	0008	0,42	1,16–7,2	3,28	0,03	0,31	6,2/0,27
Time from 1st vascular intervention	−0,02	0,19	−0,18	−0,05/0,01	−0004	0,67	−0,05	−0,02/0,01
NRS at admission	0,06	0,83	0,03	−0,52/0,64	0,40	0,03	0,30	0,02–0,79
DM	0,56	0,65	0,08	−1,92/3,04	0,36	0,73	0,05	−1,8/2,54
HA	0,60	0,45	0,12	−1,68/0,77	−0,31	0,51	−0,09	−1,3/0,66
CHF	0,91	0,51	0,12	−1,26/2,45	0,33	0,56	0,08	−0,83/
IHD	0,63	0,57	0,09	−0,94/1,66	0,19	0,64	0,06	−0,65/1,04
TEMPS-D	−1,66	0,71	−0,08	−10/7,4	−3,55	0,27	−0,20	−10,0/2,97
TEMPS-C	1,63	0,62	0,11	−5,1/8,4	0,91	0,70	0,07	−3,9/5,7
TEMPS-H	2,45	0,07	0,27	0,11/10,0	−1,03	0,55	−0,07	−4,5/2,5
TEMPS-I	−1,79	0,55	−0,11	−7,9/4,3	−4,5	0,07	−0,26	−8,8/-0,14
TEMPS-A	−0,70	0,82	−0,05	−6,9/5,5	3,6	0,10	0,33	−0,8/8,1

Abbreviations: TEMPS_D, depressive temperament; TEMPS_C, cyclothymic temperament; TEMPS_H, hyperthymic temperament; TEMPS_I, irritable temperament; TEMPS_A, anxious temperament; HADS_A, Hospital Anxiety and Depression Scale – anxiety scale; HADS_D, Hospital Anxiety and Depression Scale – depression scale; DM, diabetes mellitus; HA, hypertension arterialis; CHF, congestive heart failure; IHD, ischemic heart disease; NRS, numerical rating scale.

disorders has been extensively documented, albeit still not comprehensively understood.[19] This relationship is attributed to shared biological factors such as dysregulation of the hypothalamic-pituitary-adrenal axis and autonomic, coagulation, and immune systems, along with endothelial dysfunction. Behavioral factors, including tobacco use, physical inactivity, and medical non-adherence, also contribute to this nexus.[20] Despite the prevailing focus on coronary artery disease, PAD, an equally significant cardiovascular disease associated with an increased risk of coronary heart disease, remains comparatively under-researched.[21] With its global prevalence affecting over 230 million individuals and posing a substantial burden of disability,[22] PAD stands as a critical cause of cardiovascular morbidity and mortality. Apart from traditional cardiovascular risk factors such as age, smoking or diabetes, which contribute to occurrence and progression of PAD, there are new epidemiological insights including also the role of psychology. Psychological facets seem to be very important considering the development of the disease and its course.

Our study sought to investigate the correlations between demographic and clinical parameters, psychological aspects such as temperaments, and the prevalence and intensity of depressive and anxiety symptoms in patients with PAD.

Consistent with prior research,[4,5,10,21,23,24] our findings (Table 3) reaffirm the high incidence of depressive and anxiety symptoms in PAD patients. Recent studies have further indicated that depression and anxiety correlate with the progression and severity of PAD. Conventionally, the severity of lower extremity PAD has been assessed using Fontaine

and Rutherford classifications based on claudication distance. However, additional parameters, as demonstrated in meta-analyses, indicate a higher risk of all-cause mortality, impaired physical functioning, and poorer post-revascularization outcomes in patients with comorbid depressive symptoms.[10,25,26]

Moreover, investigations have highlighted the association between depression and anxiety with adverse post-revascularization results. Furthermore, patients with PAD and depressive symptoms showed more impaired physical functioning confirmed by physical performance tests such as maximum walking distance, pain-free walking distance, 6-minute walk distance or walking speed.[20,27] When present, depression and anxiety are associated with worse post-revascularization outcomes.

Studies by Cherr et al[28,29] revealed that depressed patients undergoing revascularization exhibited reduced patency and increased risk of recurrent symptomatic PAD and coronary heart disease events. They also did not demonstrate an association between depression and type of intervention- endovascular, open, or hybrid.[28,29] So did other researchers in the matter of depression and anxiety in the population with chronic limb threatening ischemia. A study by Harris et al[8] demonstrated a higher incidence of major amputations and increased hospitalization costs in patients with coexisting depression and anxiety, particularly those undergoing surgical revascularization. Moreover, the coexistence of depression and anxiety in this group was associated with a longer length and higher costs of hospitalizations. On the other hand, hospitalizations during which depressed patients underwent surgical revascularization, were associated with a higher odds of major amputation and a longer length of stay.

Consistent with the previous observations, we also found that the course of PAD and the intensity of depressive and anxiety symptoms are codependent. Our analysis (Table 4) revealed significant positive correlations between depressive and anxiety symptoms and clinical manifestations of PAD, notably the ABI of the operated limb and pain intensity upon admission, although the significance was more pronounced for depressive symptoms. Contradictorily, the study of Aquarius et al[30] did not find a predictive relationship between ABI and depressive symptoms in PAD. However, ABI has been implicated as a potential marker for postoperative delirium and cognitive impairment in various studies. There was also a strong suggestion that ABI may be a predictive marker of cognitive impairment in general population.[31]

The co-occurrence of mood and memory disorders is frequently observed, and this trend extends to patients with CVDs. These conditions significantly impact a patient's ability to cope with self-management of their illness and adhere to treatment plans. In many cases, mood disorders and pain are intertwined, demonstrating a bidirectional relationship. In PAD, pain represents a fundamental symptom. Although the literature lacks precise information on the direct association between depression or anxiety and complaints of pain in PAD, this interplay has been extensively documented in various somatic diseases. The mechanism underlying this relationship is intricate and multifaceted, involving the activation or modification of common brain anatomical structures, as well as the engagement of shared neurocircuitries and neurochemicals.[32]

The relationship between diseases stemming from atherosclerosis and temperament has been the subject of limited research, yielding inconsistent findings.

Hungarian researchers conducted a study that unveiled an independent and significantly negative association between hyperthymic temperament and the severity of atherosclerosis in coronary arteries.[14] This temperament trait was also linked to a reduced risk of severe ischemic heart disease.[12] Furthermore, cyclothymic temperament has been identified as being associated with accelerated vascular aging in women.[13]

The concept of affective temperaments underscores their substantial role in the development of depressive and anxiety disorders, as highlighted in numerous population and clinical studies within the realms of mental and somatic illnesses.[33–36] However, in our study, despite revealing significantly heightened depressiveness and anxiety traits and diminished hyperthymicism, there were no substantial correlations found in the severity of depression and anxiety symptoms measured using the HADS scale. Notably, the markedly lower intensity of irritability in the study group might have played a protective role. Cyclothymia did not differ significantly between the groups, although in prior studies, it was associated with mood disorders in addition to depression.

It's important to note that the HADS scale primarily assesses the presence of anxiety or depression states in medical non-psychiatric contexts within a given clinical setting,[37] and it may be less sensitive to the symptoms of endogenous depression. Nonetheless, the analysis of factors that exhibited a significant relationship with symptoms of anxiety and

depression in our study population underscores their strong association with illness-related suffering. A low ABI signifies a more advanced atherosclerotic process in the limb, subsequently leading to more severe symptoms. This is supported by the analysis of reported pain complaints, which correlate significantly with the severity of depression and, to a slightly lesser extent, anxiety. Consequently, it is plausible that pronounced somatic symptoms could overshadow the role of temperament in the development of anxiety and depression within the study group.

Interestingly, our findings indicate a statistical tendency between depressive symptoms and the number of previous vascular procedures, while multivariable analysis emphasized the significant association of complete or partial amputations with depressive and anxiety symptoms (Table 6). Surprisingly, parameters such as time from the first procedure and ABI of the non-operated leg turned out to be insignificant, contrary to expectations based on the disease's clinical stage. Nevertheless, previous studies have not extensively explored this aspect.

Psychometric properties for HADS subscales and NRS in our study cohort, categorized by the type of revascularization, demonstrated that surgical procedures were associated with higher levels of depressive symptoms than percutaneous transluminal angioplasty (PTA), akin to observations in ischemic heart disease.[38]

Contrary to established associations between depression/anxiety and comorbidities like diabetes, hypertension, and ischemic heart disease in numerous studies,[3,39–41] our study did not ascertain significant links between the incidence of these comorbidities and higher levels of anxiety or depression. This divergence might suggest that symptoms of PAD, notably chronic pain and functional disability, exert a more substantial influence on the development of depression and anxiety disorders compared to other factors. This speculation is plausible in light of the complex pathophysiology of pain and its psychological ramifications.

However, certain authors have failed to establish clear associations between depression and conditions like diabetes, hypertension, or ischemic heart disease.[28] This discrepancy might be explained by the fact that symptoms specific to PAD, such as chronic pain or functional disability, potentially hold more significance in the development of depression and anxiety disorders compared to other contributing factors. This assumption appears plausible, particularly given the intricate nature of pain's pathophysiology and its considerable psychological impact.

Nevertheless, our study has limitations. The psychological evaluation timings were not uniformly standardized, and sample sizes for specific comorbidities within PAD, especially chronic heart failure, were relatively small. Consequently, the inability to establish relationships between depressive or anxiety symptoms and other comorbidities may stem from the smaller population sizes for each comorbidity.

In conclusion, our study underscores a high prevalence of depressive and anxiety symptoms in PAD patients, suggesting an association between their intensity and the progression of PAD. It is concerning that depression and anxiety might still be underdiagnosed and undertreated. Their proper management appears crucial, given their impact on the progression of somatic diseases. However, integrating additional mental disorder screening tests for all patients into routine clinical practice remains challenging. Therefore, efficient identification of patients at risk becomes pivotal. Rigorous screening for mood disorders in PAD patients is crucial, given their predictive value for poor prognosis. Evidence indicates that untreated depression poses an increased risk of amputation in PAD patients.[25] Therapeutic interventions targeting mental health may potentially influence the course and prognosis of PAD and warrant further clinical exploration. Simultaneously, addressing pain-related symptoms is pivotal, as the complex interplay between pain and mood disorders significantly impacts patients' coping mechanisms and treatment adherence.

Disclosure

The authors report no conflicts of interest in this work.

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