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Assessing the Risk of Stroke in the Elderly in the Context of Long-COVID, Followed Through the Lens of Family Medicine

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Abstract. *Background/Aim: Patients infected with COVID-19 may experience a range of acute and chronic neurological disorders. While severe neurological complications like strokes and seizures were less common during the acute or post-COVID period, the long-term effects of COVID-19, known as long COVID, have received limited attention. This study aimed to examine the lasting consequences of SARS-CoV-2 infection and establish potential connections with related diseases. Patients and Methods: We followed a group of 157 patients for one year, predominantly from urban areas (61.8%), divided into three groups based on the presence of associated diseases that pose health risks: the control (43 patients), low-risk (67 patients), and high-risk (47 patients) groups. Results: We observed an inverse relationship between oxygen saturation and erythrocyte sedimentation rate, as well as a direct relationship between varicose disease and dyslipidemia, and gastrointestinal disease. Additionally, we noticed a less significant improvement in oxygen saturation and increased prevalence of psychoanxiety disorders in individuals undergoing anticoagulant treatment. Conclusion: The impact of long COVID and its secondary effects, which persist for an extended period and are influenced by associated diseases, can be effectively monitored and addressed by primary care physicians. These findings can serve as a basis for developing more efficient approaches to managing the long-term consequences of COVID-19.*

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COVID-19 patients have the potential to develop various acute neurological disorders, such as loss of taste and smell (ageusia and anosmia), abnormal brain wave patterns (epileptiform abnormalities), brain inflammation (encephalopathy), stroke (cerebral infarction), nerve damage in the extremities (peripheral neuropathy), and muscle inflammation (myositis). The long-term neurological conditions associated with COVID-19 are not yet clearly defined, but commonly reported syndromes include dysautonomia (problems with the autonomic nervous system), neurocognitive dysfunction, different types of pain syndromes, persistent fatigue, and reduced tolerance for physical exertion (1).

A retrospective observational case series conducted in Wuhan revealed that a significant proportion (36.4%) of 214 hospitalized patients with SARS-CoV-2 infection exhibited some form of neurological involvement. This indicates that neurological manifestations may be overlooked and not adequately reported in the progression of the disease. Among patients with central nervous system (CNS) involvement, the most frequently reported symptoms were headache (13%) and dizziness (17%). However, more severe neurological complications, such as strokes and seizures, were less prevalent, occurring in only 3% and 0.5% of cases, respectively (2).

Antiphospholipid syndrome (APS) is distinguished from other coagulation disorders by its prominent occurrence of arterial thromboses. The most frequently observed arterial thromboses in APS affect the intracranial arteries, resulting in strokes and transient ischemic attacks (TIAs). Other arteries that may be affected include the retinal, coronary, mesenteric, and peripheral arteries. The specific clinical presentation of APS depends on the location of the occlusion.

Additionally, the presence of antiphospholipid antibodies (aPL) has been associated with malignant hypertension accompanied by renal failure due to thrombosis in the renal glomeruli and renal thrombotic microangiopathy, even in the absence of classic lupus nephritis (3). Similar to venous thrombosis, arterial events in antiphospholipid syndrome (APS) typically occur at a specific location and have the potential to recur after several months or even years (4).

Vitamin K antagonists (VKAs) were initially employed as oral anticoagulants (OACs) for stroke prevention in patients. When compared to control groups (no treatment or acetylsalicylic acid), VKA treatment offers several advantages. These include a 25% decrease in mortality and a two-thirds reduction in the risk of stroke (5). Direct oral anticoagulants (DOACs), also known as non-Vitamin K antagonist oral anticoagulants (non-VKAs), encompass medications such as dabigatran, rivaroxaban, edoxaban, betrixaban, and apixaban. These DOACs have been developed as alternative options to VKAs for anticoagulation therapy (5-7). In follow-up patients, the use of antiplatelet agents has been shown to reduce the risk of stroke by 20%. On the other hand, the use of warfarin, a Vitamin K antagonist, has been associated with a more significant reduction in the risk of stroke, up to 60% (8). When the CHA2DS2-VASc score is equal to or greater than 2, oral anticoagulant (OAC) treatment is recommended. However, when the score is 0, anticoagulant treatment is generally not recommended. For patients with a CHA2DS2-VASc score of 1, the decision regarding anticoagulant treatment should be individualized, as the risk of stroke is relatively low. The assessment should take into account other factors, such as patient preferences, bleeding risk, and other clinical considerations (9). In the population aged 65 years and older, particularly among women, there is an increased risk of ischemic stroke. For this specific group, anticoagulant treatment has been shown to reduce the mortality rate (10). DOACs serve as alternative options to VKAs for patients with non-valvular atrial fibrillation (AF). It is important to note that the use of nonsteroidal anti-inflammatory drugs (NSAIDs) in AF patients taking anticoagulants can increase the risk of thromboembolism or severe bleeding. Therefore, caution should be exercised when administering NSAIDs to AF patients receiving anticoagulant therapy (11).

The primary objective of this study was to gain a deeper understanding of the impact of the SARS-CoV-2 virus pandemic, including its immediate effects (such as fever, lung damage, fatigue, and ocular manifestations) that can be monitored through clinical and paraclinical parameters (12). Furthermore, the study aimed to investigate both short-term effects (such as the development of diabetes and gastrointestinal disorders) and long-term effects (including joint diseases, cardiomyopathy, and psychoanxiety disorders) associated with the virus.

Specifically, the study aimed to assess the correlation between clinical parameters and diseases related to thrombosis in the context of long COVID. Additionally, the research seeked to identify risk factors for patients who have previously contracted and recovered from COVID-19.

Patients and Methods

Clinical diagnostics. The clinical evaluation of the patients in this study was conducted using the Tanita MC780MA body bioelectrical impedance analyzer (BIA), developed by Tanita Corporation in Tokyo, Japan (13, 14). The results obtained from the clinical evaluation were analyzed using GMON 3.4.1 medical software, which is a software developed by a company called GMON in Chemnitz, Germany. The BIA type body analyzers used in the study are accepted by the World Public Health Nutrition Association (WPHNA) and are known for their high accuracy in determining body composition. The margin of error for the measurements taken with the BIA analyzer was 0.1 kg.

In addition to the body composition analysis, oxygen saturation levels were measured using a CNOGA pulse oximeter. The CNOGA pulse oximeter is a device developed by a company called CNOGA in Caesarea, Israel, and it was used to assess the oxygen saturation levels in the study participants.

Paraclinical diagnosis. To track the effects of long COVID, paraclinical evaluations were performed in this study. The presence of thrombosis was diagnosed and confirmed. To further establish the presence of long COVID-related disorders, monthly consultations were conducted.

Paraclinical analyses were carried out in the laboratory using enzymatic, colorimetric, and spectrophotometric methods, as well as immuno-enzymatic tests. Various parameters were monitored, including International Normalized Ratio (INR), fibrinogen levels, erythrocyte sedimentation rate (ESR), dyslipidemias, and blood glucose levels. These parameters were assessed both at the beginning and at the end of the research period to evaluate any changes or correlations.

The laboratory analyses helped provide insights into the biochemical and immune system responses associated with long COVID, shedding light on potential links between these parameters and the long-term effects of the disease.

Statistical analysis. The data collected from the study were analyzed using the statistical software SPSS 20 (IBM, Chicago, IL, USA), which is commonly used for statistical analysis. Various statistical tests were employed to examine the data, including analysis of variance (ANOVA), Post-Hoc analysis, Chi-square test, inferential statistics (such as the Student's *t*-test), and the Bonferroni test for comparing the three research groups.

To assess the relationships between different parameters, Bravais-Pearson tests were used to determine correlations. Additionally, pairwise correlation of samples was conducted to examine the associations between specific variables.

These statistical analyses were employed to derive meaningful insights from the data and identify any significant relationships or differences among the variables under investigation.

Patient selection – inclusion and exclusion criteria. The patients included in the study were selected based on their presentation

Table I. *Demographic description*.

Demographic parameters	N	%
Sex		
Male	88	56.1
Female	69	43.9
Environment		
Urban	97	61.8
Rural	60	38.2
Educational preparation		
Middle school studies	100	63.7
Superior studies	57	36.3
Age (average/SD)	71.4777	9.35660

N: Number of patients; SD: standard deviation.

between August 2021 and August 2022, following the guidelines set forth in the Declaration of the World Medical Association of Helsinki. All patients had a confirmed diagnosis of thrombosis. The study specifically focused on patients aged 53 to 87 years. These patients experienced mild to moderate or asymptomatic SARS-CoV-2 infection and were being treated for varicose and/or hemorrhoidal thromboembolism with stable allopathic treatment.

Certain exclusion criteria were applied, including a history of malignant tumors, organ failure, autoimmune pathologies, and severe forms of COVID-19. The sample size for the study was determined based on the total number of patients who visited the family medicine practice during the study period. To calculate the sample size, various variables were considered, such as the probability (p) of the occurrence of the phenomenon (with a range of $0 \leq p \leq 1$), the counter probability (q), the probability factor (t), the allowed error limit (Δx), and the volume of the collective (N).

The sample size was calculated using the formula: n=t^2pq/(Δx^2+t^2pq/N). In this case, the formula assumes that the observed characteristic is the alternative (in this case, healthy *vs*. sick). The value of 'n' represents the maximum sample size. For this calculation, a probability of 95% corresponds to a value of t=1.96, and a margin of error of 0.1 was set. Since the value of N was relatively large (1,256), the ratio t^2pq/N was neglected. The calculated sample size based on the formula was n=85.

Demographic data. Table I presents the cohort of 157 patients, with the majority (61.8%) coming from an urban environment. The differences in the distribution between urban and rural environments were found to be insignificant (p=0.358). The breakdown of the study cohort by sex was as follows: Men from the urban environment accounted for 43.3% of the cohort, which was higher than men from the rural environment, who represented only 12.7%. Women from the urban environment made up 18.5% of the cohort, while women from the rural environment accounted for 25.5%.

The cohort was divided into three groups based on the presence of associated diseases that represent a health risk. Table II provides a description of these groups. The average age in the control group was 70.91±9.69 years, in the low-risk group it was 72.40±9.16 years, and in the high-risk group, it was 70.68±9.42 years. The differences in average age between the groups were found to be statistically insignificant (p=0.564).

Table II. *Distribution of patients according to batch*.

Groups	N	%
Control group	43	27.4
With low risk	67	42.7
With high risk	47	29.9

N: Number of patients.

Table III. *Pearson correlation of demographic parameters and differences in clinical parameters*.

Pearson correlation	Sex	Age	Environment
BMI			
r	0.134	–0.013	–0.169*
p-Value	0.094	0.876	0.034
Visceral fat			
r	0.055	0.161*	0.126
p-Value	0.493	0.043	0.115
O_2 saturation			
r	0.081	–0.208**	0.042
p-Value	0.312	0.009	0.604
Associated diseases			
r	–0.050	0.157*	0.293**
p-Value	0.535	0.049	0.001
N	157		

N: Number of patients; r: Pearson coefficient; *p*-Value: statistical significance. *Correlation is significant at the 0.05 level. **Correlation is significant at the 0.01 level.

Results

Correlation of demographic data with research parameters. Table III displays the Pearson correlation coefficients that assess the relationships between various demographic parameters (such as sex, age, and environment of origin) and clinical parameters (including BMI, visceral fat, O2 saturation, and associated diseases), along with their corresponding statistical significance.

Figure 1 shows the relationships between the differences in BMI and background (A), age and visceral fat (B), O2 saturation (C), and associated diseases (D), as well as the diseases associated with background at the cohort level. These figures provide a graphical representation of the observed associations between these variables.

Relationship between pretest–posttest differences. The correlation between BMI and environment of origin yielded a Pearson coefficient of r=–0.169, p<0.05, indicating a strong negative relationship. This means that BMI tends to increase more in individuals living in urban areas. This relationship is supported not only by the negative value of the Pearson

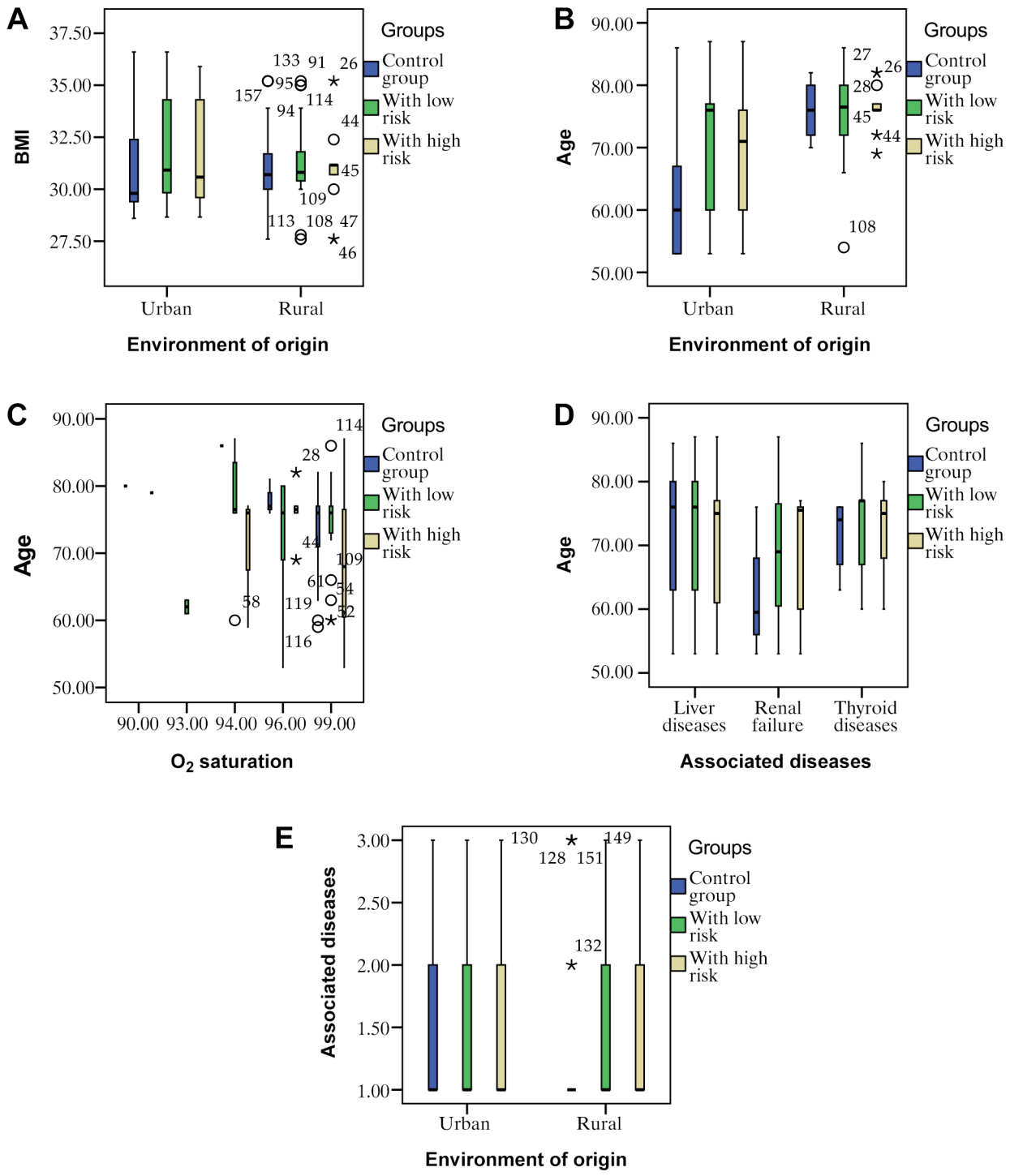

Figure 1. *Relationship between differences in BMI difference and environment of origin (A), age and environment of origin (B) age and oxygen saturation (C), age and associated diseases (D), associated diseases and environment of origin (E), divided into the three research groups.*

coefficient but also by the statistical significance below 0.05. Figure 1A illustrates the difference in BMI in relation to the environment of origin. The standard deviation in the graphical representation shows that the control group initially had a higher BMI value than the final one, while the low-risk group exhibited a larger standard deviation, indicating

Table IV. *Pearson correlation of differences in research parameters.*

Pearson Correlation	BMI	Visceral fat	O_2 saturation	Diabetes	Associated diseases	Varicose disease	Joint diseases	Cardiomyopathies
Dyslipidemia								
r	–0.110	–0.124	0.034	0.066	0.009	0.181*	–0.154	–0.076
p-Value	0.172	0.122	0.668	0.413	0.913	0.023	0.054	0.343
Gastrointestinal diseases								
r	0.016	0.098	0.001	0.091	–0.015	0.164*	0.083	0.008
p-Value	0.840	0.221	0.992	0.256	0.852	0.040	0.299	0.924
Psychoanxiety disorders								
r	–0.176*	–.0120	0.012	–0.238**	–0.112	–0.006	–0.176*	–0.161*
p-Value	0.027	0.135	0.883	0.003	0.163	0.938	0.027	0.044
VSH								
r	0.105	0.124	–0.179*	0.109	0.093	0.029	0.010	0.117
p-Value	0.189	0.122	0.025	0.176	0.248	0.716	0.898	0.146
Glycaemia								
r	0.053	–0.113	0.051	–0.021	0.199*	0.007	0.040	–0.048
p-Value	0.510	0.160	0.529	0.799	0.013	0.934	0.618	0.551
N	157	157	157	157	157	157	157	157

N: Number of patients; r: Pearson coefficient; *p*-Value: statistical significance. *Correlation is significant at the 0.05 level. **Correlation is significant at the 0.01 level.

significant changes. No significant differences were observed in the high-risk group.

The correlation between age and environment of origin resulted in a Pearson coefficient of r=0.161, $p<0.05$, indicating a positive relationship. This implies that age tends to be higher in individuals from rural areas. This relationship is supported by the positive value of the Pearson coefficient and the statistical significance below 0.05. Figure 1B displays the age distribution in relation to the environment of origin, indicating that age is generally higher in the rural environment.

The correlation between O2 saturation and age yielded a Pearson coefficient of r=–0.208, $p<0.05$, indicating a strong negative relationship. As age increases, O2 saturation decreases in the context of long-COVID. This relationship is supported by the negative value of the Pearson coefficient and the statistical significance below 0.05. Figure 1C illustrates the decrease in O2 saturation with increasing age across the three research groups. The high-risk group experienced the greatest decline in O2 saturation, whereas the control group was the least affected.

The correlation between associated diseases (liver diseases, renal failure, and thyroid diseases) and age resulted in a Pearson coefficient of r=0.157, $p<0.05$, indicating a positive relationship that is statistically significant. As age increases, the incidence of associated diseases also tends to increase. Figure 1D presents the correlation between associated diseases and age across the three research groups. In the control group, liver diseases were most common, whereas in the low-risk group, thyroid diseases were more prevalent, and in the high-risk group, renal insufficiency was predominant among the oldest age group.

Table V. *Pearson correlation of the difference between antithrombotic treatment and the difference in fibrinogen.*

Pearson correlation	Antithrombotic treatment
Fibrinogen	
r	0.249**
p-Value	0.002
N	157

N: Number of patients; r: Pearson coefficient; *p*-Value: statistical significance. **Correlation is significant at the 0.01 level.

The correlation between associated diseases (liver diseases, renal failure, and thyroid diseases) and environment of origin yielded a Pearson coefficient of r=0.293, $p<0.05$, indicating a strong positive relationship. In urban environments, the incidence of liver and kidney diseases tends to be higher, whereas in rural areas, the incidence of thyroid diseases increases. This relationship is supported by the positive value of the Pearson coefficient and the statistical significance below 0.05. Figure 1E shows the correlation between associated diseases and environment of origin for each disease at the end of the research period. The control group had the highest incidence of liver diseases in the rural environment, whereas the low-risk group had a slightly higher incidence in the urban environment. The high-risk group exhibited a higher incidence of liver diseases in the urban environment. Renal failure was more prevalent in individuals from urban environments across all three research groups. Thyroid diseases predominantly affected the low-risk group, particularly those from urban environments.

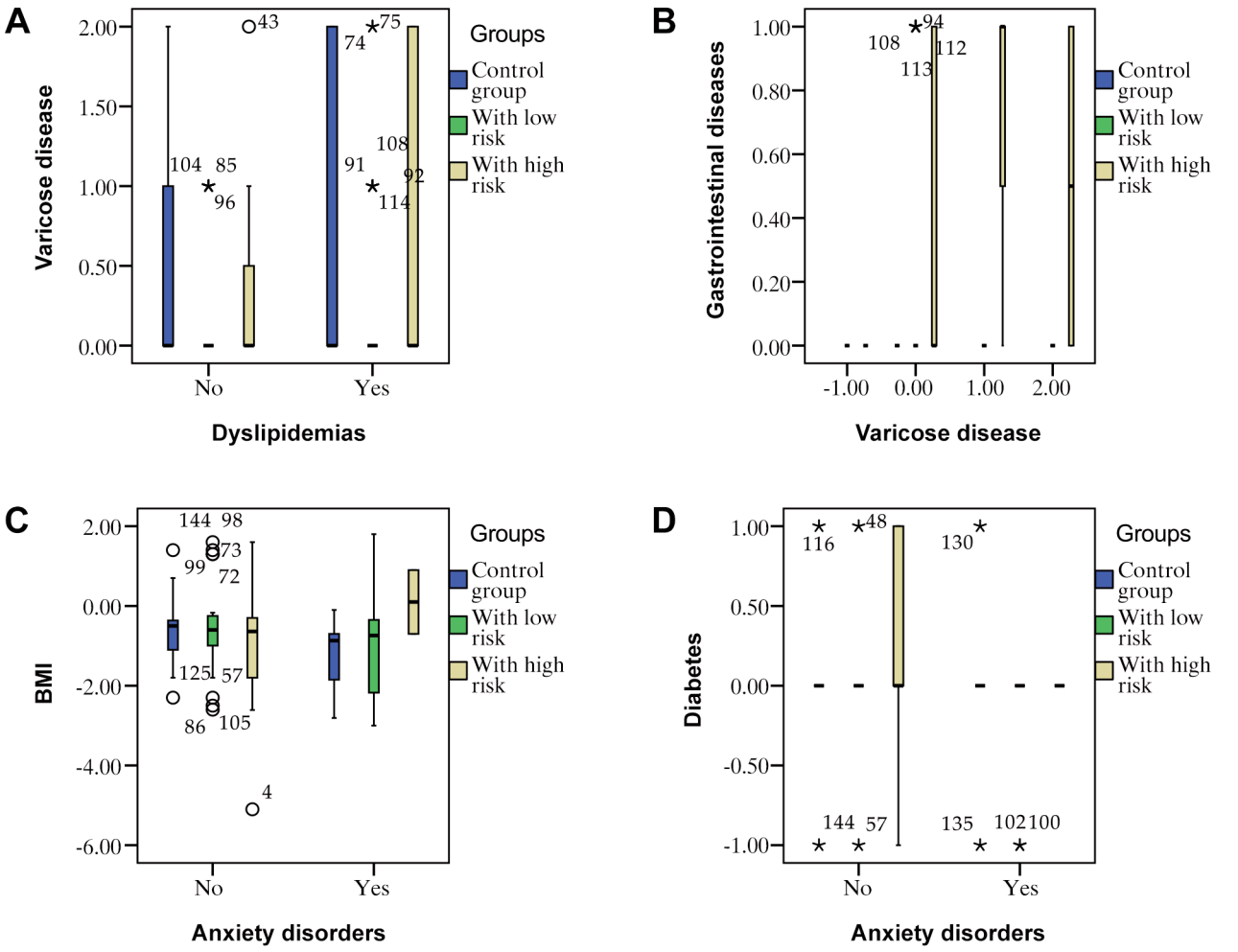

Figure 2. *Continued*

Correlation of research parameters. Based on the statistical analysis of the research data, several significant correlations were observed. There was a positive and statistically significant correlation between the incidence of dyslipidemia and varicose disease. As the incidence of dyslipidemia increased, the incidence of varicose disease also tended to increase.

A positive and statistically significant correlation was also found between gastrointestinal disease and varicose disease. As the incidence of gastrointestinal disease increased, the incidence of varicose disease also tended to increase.

Furthermore, there was a positive and statistically significant correlation between glycemia (blood glucose levels) and associated diseases. As glycemia increased, the incidence of associated diseases also tended to increase.

Additionally, a strong negative relationship was observed between psychoanxiety disorders and several health conditions:

BMI. There was a negative correlation between psychoanxiety disorders and BMI. As the incidence of psychoanxiety disorders increased, the difference in BMI tended to decrease.

Diabetes. Psychoanxiety disorders were negatively correlated with diabetes. As the incidence of psychoanxiety disorders increased, the incidence of diabetes tends to decreased.

Joint diseases. A negative correlation was found between psychoanxiety disorders and joint diseases. As the incidence of psychoanxiety disorders increased, the incidence of joint diseases tended to decrease.

Cardiomyopathies. Psychoanxiety disorders were negatively correlated with cardiomyopathies. As the incidence of psychoanxiety disorders increased, the incidence of cardiomyopathies tended to decrease.

In summary, the presence of dyslipidemia, gastrointestinal disease, and higher glycemia levels were associated with an

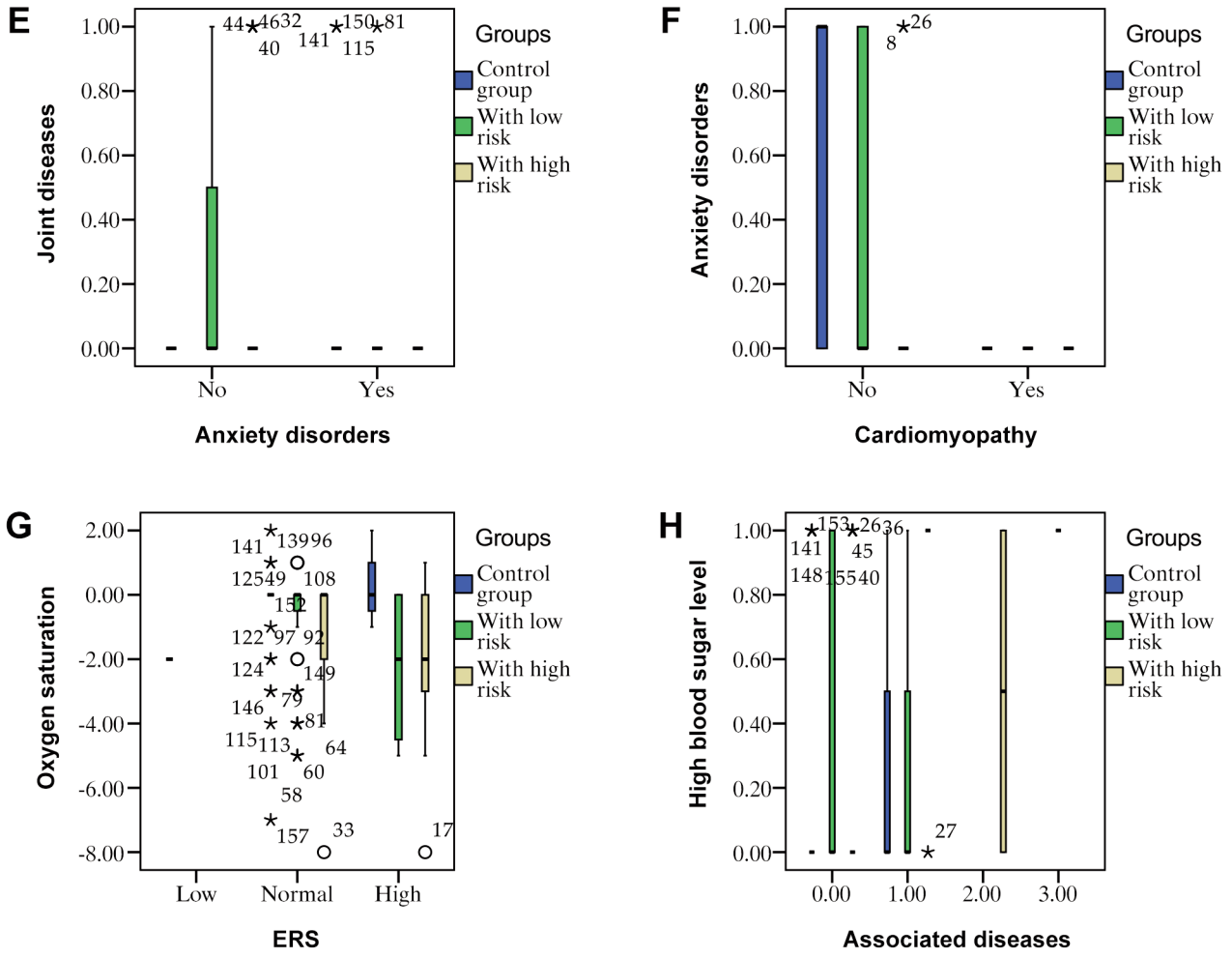

Figure 2. *Relationship between differences in varicose disease and dyslipidemias (A), varicose disease and gastrointestinal disease (B), psychoanxiety disorders and BMI (C), diabetes (D), joint disease (E) and cardiomyopathies (F), O_2 saturation and ESR (G), blood sugar level and associated diseases (H), divided among the three research groups.*

increased incidence of varicose disease and associated diseases. Conversely, the presence of psychoanxiety disorders showed a negative relationship with BMI, diabetes, joint diseases, and cardiomyopathies, indicating that patients with psychoanxiety disorders were less likely to have worsening BMI, diabetes, joint diseases, or cardiomyopathies.

Based on the provided information, the correlations, presented in Table IV, between various factors and their impact on varicose disease, anxiety disorders, BMI, joint diseases, diabetes, cardiomyopathy, oxygen saturation, and associated diseases can be summarized as follows:

Dyslipidemias and varicose disease. Figure 2A illustrates the correlation between dyslipidemias and varicose disease in the three research groups. The high-risk group showed a significant increase in the incidence of varicose veins and hemorrhoids among patients with dyslipidemia. In the control and low-risk groups, although some changes were observed, they did not reach statistical significance.

Gastrointestinal diseases and varicose disease. Figure 2B depicts the relationship between gastrointestinal diseases and varicose disease. The high-risk group demonstrated the highest differences, with patients having gastrointestinal diseases being more likely to present with severe varicose disease, including varicose veins with hemorrhoids. In contrast, patients without gastrointestinal diseases had a higher incidence of varicose veins.

Anxiety disorders. Figure 2C highlights the increasing trend of anxiety disorders, particularly in the high-risk group. However, anxiety disorders were present in all three groups, consistent with findings from previous research.

BMI and anxiety disorders. The correlation between psychotic disorders and BMI showed a higher incidence in

patients with higher BMI, especially in the high-risk group (Figure 2C).

Diabetes and anxiety disorders. Similarly, Figure 2D indicates an inverse relationship between the incidence of diabetes and psychoanxiety disorders. Higher incidence of psychoanxiety disorders was associated with a lower incidence of diabetes.

Joint diseases and anxiety disorders. Figure 2E demonstrates an inversely proportional relationship between the incidence of joint diseases and psychoanxiety disorders. As the incidence of psychoanxiety disorders increased, the incidence of joint diseases tended to decrease.

Oxygen saturation and ESR. A directly proportional relationship was observed between oxygen saturation and erythrocyte sedimentation rate (ESR). The higher the ESR, the lower the oxygen saturation, particularly notable in the high-risk group (Figure 2G).

Blood sugar and associated diseases. Figure 2H demonstrates the positive correlation between blood sugar levels and associated diseases such as liver disease, kidney failure, and thyroid disease. As blood sugar levels increased, the incidence of associated diseases tended to increase.

These correlations provide valuable insights into the relationships between different factors and their impact on varicose disease, anxiety disorders, BMI, joint diseases, diabetes, cardiomyopathy (Figure 2F), oxygen saturation, and associated diseases in the context of the study's cohort.

Correlation of paraclinical parameters with administered antithrombotic treatment. Based on the statistical processing of the research data, a significant correlation was found between antithrombotic treatment (specifically DOACs-type anticoagulants) and fibrinogen levels. The correlation was directly proportional, indicating that patients with higher fibrinogen levels benefited more from the use of DOACs-type anticoagulant treatment.

Table V presents the data related to this correlation, showcasing the relationship between antithrombotic treatment and fibrinogen levels. It is important to note that higher fibrinogen levels were associated with a greater benefit from DOACs-type anticoagulant treatment. This finding suggests that patients with elevated fibrinogen levels may require more aggressive anticoagulation therapy to manage their thrombotic condition effectively.

The details and specific values related to the correlation between antithrombotic treatment and fibrinogen levels can be found in Table V, providing insights into the relationship between these two variables in the study cohort.

By utilizing the "error bar" method in Figure 3, individuals undergoing AVK treatment exhibited a more pronounced enhancement in O2 saturation (Figure 3A) and a reduction in psychoanxiety disorders (Figure 3E). There was no discernible variation in diabetes prevalence among those receiving VKA treatment. Conversely, individuals who experienced an upsurge in diabetes (Figure 3B), joint diseases (Figure 3C), and gastrointestinal diseases (Figure 3D) predominantly received treatment with DOACs.

Discussion

The current study reveals a lack of statistically significant correlation between BMI and sex, aligning with numerous similar studies conducted by peers (15, 16). In certain studies investigating muscle or bone mass loss, a parallel relationship between age and BMI can be observed (17, 18). In this particular study, the correlation between age and BMI was not found to be statistically significant. The impact of a sedentary lifestyle and dietary habits, such as consuming fast food in urban settings, appears to have a more pronounced influence on the evolution of BMI (19). This study identified a statistically significant Pearson correlation between BMI and background, indicating that individuals from urban environments tend to have higher BMI values. This can be attributed to the prevalence of sedentary lifestyles, particularly among the elderly population, as well as the adoption of unhealthy dietary patterns. Moreover, an increase in visceral fat was observed among elderly patients (20). Consistent with previous studies, our research findings also confirm that visceral fat increases significantly with age. This observation is supported by multiple studies, including our own (21, 22).

Oxygen saturation, particularly in the context of the pandemic, has garnered considerable attention. It has been observed that the elderly population is more susceptible to experiencing hypoxia both in the post-COVID and long COVID phases (23, 24). In this study, a significant decline in oxygen saturation was observed after one year of the pandemic. Additionally, there was an inverse relationship between age and oxygen saturation, indicating that older individuals tended to have lower oxygen saturation levels.

Ejas *et al*. (2020) examined the impact of comorbidities on the long-term progression of COVID-19 and found that associated diseases have a negative influence on its long-term outcomes (25-27). In this study, the presence of associated diseases was found to be correlated with both age and background. This correlation helps explain the vulnerability of the elderly population, as their pre-existing conditions were compounded by the viral lung infection of COVID-19, resulting in an increased incidence of associated diseases.

In a study conducted by Sato *et al*. in 2019 (28) the prevalence of thromboses associated with dyslipidemia and other related diseases following natural disasters was examined. This study found a statistically significant relationship in a cohort of patients aged over 70 years. In the current study, where the average age was also over 70 years, a positive and directly proportional relationship between dyslipidemia and

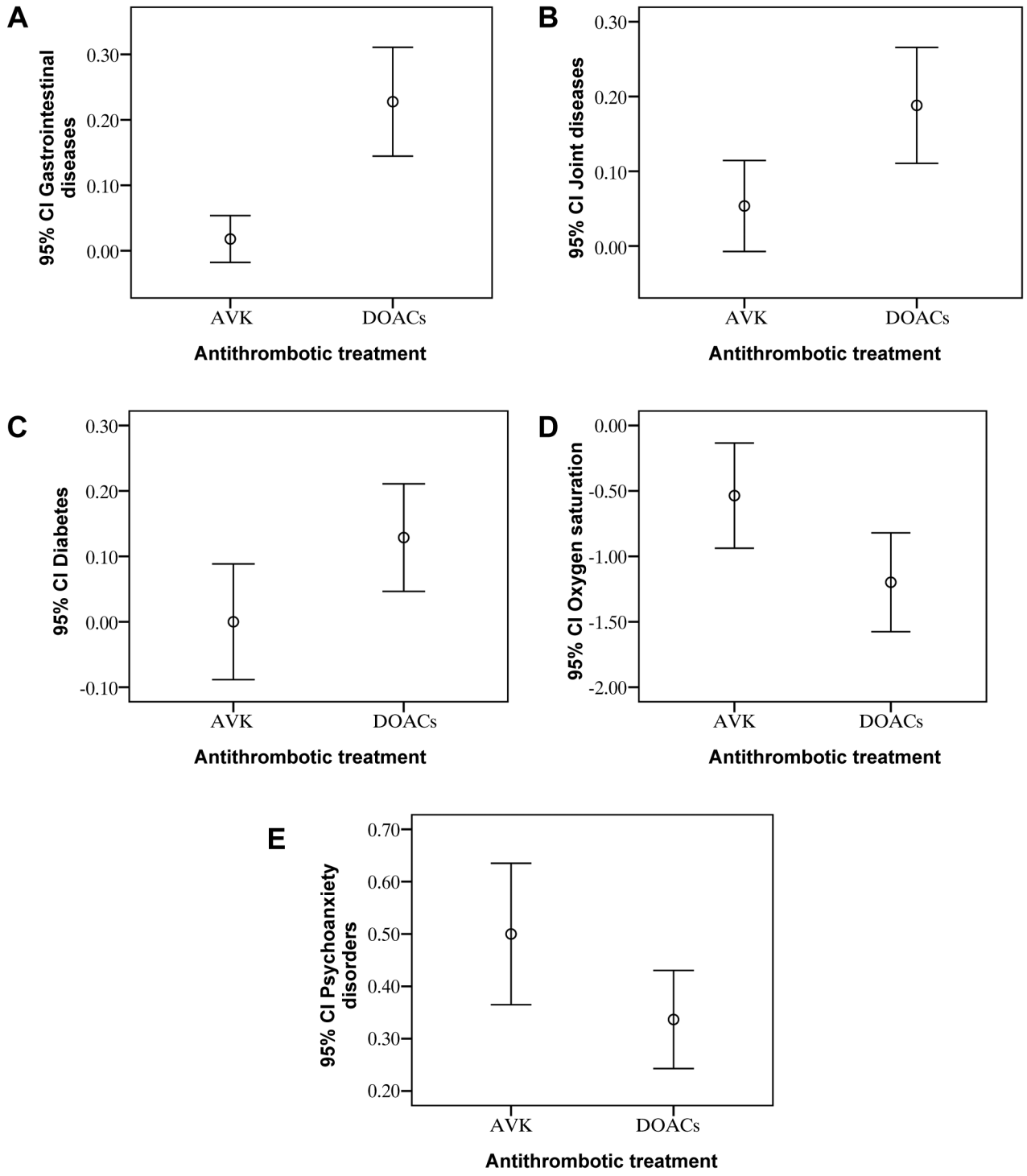

Figure 3. *Relationship between differences in antithrombotic treatment and O_2 saturation (A), diabetes (B), joint diseases (C), gastrointestinal diseases (D), and psychoanxiety disorders (E).*

varicose diseases can be observed. A case study within the context of COVID-19 reported thrombosis and ischemic hemorrhoidal bleeding in a hospitalized patient with concomitant dyslipidemia (29). Thrombosis has been associated with several risk factors, including dyslipidemia, hemorrhoids, diabetes, and hypertension. These conditions contribute to an

increased risk of thrombosis (29). Psychoanxiety disorders, including anxiety and depressive symptoms, have been reported as side effects associated with COVID-19. These effects can be attributed to various factors (30), such as social restrictions imposed during the pandemic (31, 32), and the heightened prevalence of anxiety and depressive symptoms experienced by individuals following COVID-19 infection (33).

The impact of psychoanxiety disorders on the overall behavior of patients was evident in our study, with a high prevalence of these disorders at the end of the research period. Interestingly, an inverse relationship was observed between psychoanxiety disorders and BMI, diabetes, joint diseases, and heart diseases (34-39). This could be attributed to the potential reduction in neuroinflammation through basic treatments and increased medical visits, which may help alleviate social isolation.

In patients with a greater decrease in oxygen saturation, a shift from VKA treatments to DOACs was observed. This might explain the smaller difference in oxygen saturation among patients receiving AVK class treatment, whereas a larger difference was seen in those treated with DOACs. Due to the specific properties and safety considerations, VKA treatment was combined with DOACs in patients with a higher incidence of diabetes, joint diseases, or gastrointestinal diseases.

Furthermore, our study revealed a significantly higher incidence of psychoanxiety disorders among patients undergoing VKA treatment. In a 2020 publication by Spyropoulos *et al*., a connection between oxygen saturation and the recommended antithrombotic treatment of the DOACs class was highlighted (40). Acanfora *et al*. conducted a comparative analysis between warfarin-based treatment and DOACs in patients with atrial fibrillation and diabetes. The study demonstrated the evident superiority of DOACs in terms of their effects and safety compared to warfarin (41). The use of DOACs and oral VKAs has shown beneficial effects in reducing cardiovascular and thrombotic risks in patients with psychoanxiety disorders. During the pandemic, there has been increased attention on the use of anticoagulant treatments, particularly DOACs, with various recommendations supporting their use.

Notably, the effects of long COVID have not been extensively studied in our country until now. This study represents the first exploration of anticoagulant treatment in hypertensive patients with long COVID. The findings from this study are of great significance and can serve as a valuable starting point for guiding anticoagulant treatment in the field of family medicine.

Conclusion

In this study, several correlations and observations were made: i) Dyslipidemia showed a significant correlation with the incidence of varicose veins. ii) The group with reduced risk experienced the greatest change in BMI. iii) Oxygen saturation decreased the most in the high-risk group, whereas the control group was the least affected. iv) Liver diseases were most common in the control group, thyroid diseases in the low-risk group, and renal insufficiency in the high-risk group, particularly among older individuals. v) Renal failure was more prevalent in the urban environment across all three research groups. vi) Thyroid diseases predominantly affected the low-risk group, specifically individuals from urban environments. vii) Psychoanxiety disorders were more frequent in patients whose BMI, diabetes, joint diseases, or cardiomyopathies did not worsen. viii) The incidence of psychoanxiety disorders had an inverse relationship with the incidence of joint diseases accompanied by diabetes and cardiomyopathy. ix) Patients with gastrointestinal disease had a higher incidence of severe varicose disease, particularly presenting as varicose veins with hemorrhoids, whereas those without gastrointestinal disease had the highest incidence of varicose veins in general. x) Patients with higher fibrinogen levels benefitted more from DOACs, whereas those with VKA treatment showed a less pronounced improvement in oxygen saturation and psychoanxiety.

These findings provide insights into the relationships between various factors and their impact on different health conditions, helping to better understand their associations and implications.

Conflicts of Interest

The Authors declare no conflicts of interest in relation to this study.

Authors' Contributions

Conceptualization, Andrada Florina Moldovan and Timea Claudia Ghitea; methodology, Katalin Babes; software, Evelin Claudia Ghitea; validation, Katalin Babes; formal analysis, Ioana Moga; investigation, Andrada Florina Moldovan; resources, Titus Moga; data curation, Katalin Babes; writing—original draft preparation, Timea Claudia Ghitea; writing—review and editing, Timea Claudia Ghitea; visualization, Andrada Florina Moldovan; supervision, Ioana Moga; project administration, Timea Claudia Ghitea; funding acquisition, Timea Claudia Ghitea.

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