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The Impact of Obesity and Patient-Reported Reasons on Patient Noncompliance with Compression Stockings

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ABSTRACT

Introduction: The aim of this study is to investigate the impact of obesity on patient compliance with elastic compression stockings and to reveal patient behavior-related and compression stockings-related factors for noncompliance.

Patients and Methods: Between July and August 2022, a total of 246 patients with chronic venous insufficiency were included in the study. The patients were divided into two groups, obese and non-obese patients (88 vs. 158 patients), and questioned for proper use of compression stockings and the patient-reported reasons for the non-compliance.

Results: The mean age was 49.0 ± 13.1, and the mean BMI was 28.6 ± 5.2. Only 51 patients (20.7%) out of 246 complied with stocking use. The mean number of days per week in which the compression stockings were properly used was 2.9 ± 1.7 in the study population. Patient compliance was higher in the non-obese group (12.5% vs. 25.3%, p= 0.017), and the number of days per week in which the compression stockings were worn properly was higher in the non-obese group (2.6 ± 1.3 vs. 3.1 ± 1.9, p= 0.032).

Conclusion: The compliance of our patients with elastic compression stockings was found to be as low as 20.7%. Compliance was lower in the group of obese patients. Obesity and diabetes mellitus were the only factors associated with noncompliance in univariate logistic regression analysis. Further studies are needed in larger patient populations to increase the rate of patient compliance.

Key Words: Venous insufficiency; compression stockings; compliance; obesity

Obezite ve Hasta Tarafından Bildirilen Nedenlerin Hastanın Kompresyon Çorabı ile Uyumsuzluğuna Etkisi

ÖZET

Giriş: Bu çalışmanın amacı, obezitenin elastik kompresyon çorabı ile hasta uyumu üzerindeki etkisini araştırmak ve hasta davranışı ve kompresyon çorabı kaynaklı uyumsuzluk faktörlerini ortaya çıkarmaktır.

Hastalar ve Yöntem: Temmuz-Ağustos 2022 tarihleri arasında kronik venöz yetmezliği olan toplam 246 hasta çalışmaya dahil edildi. Hastalar obez ve obez olmayan (88'e 158 hasta) olmak üzere iki gruba ayrıldı ve kompresyon çorabının uygun kullanımı ve uygunsuzluğun hasta tarafından bildirilen nedenleri sorgulandı.

Bulgular: Ortalama yaş 49.0 ± 13.1 ve ortalama vücut kitle indeksi 28.6 ± 5.2 idi. İki yüz kırk altı hastadan sadece 51'i (%20.7) uyum sağladı. Çalışma popülasyonunda kompresyon çoraplarının uygun şekilde kullanıldığı haftada ortalama gün sayısı 2.9 ± 1.7 idi. Hasta uyumu obez olmayan grupta daha yüksekti (%12.5'e karşı %25.3, p= 0.017) ve kompresyon çorabının haftada bir kez doğru giyildiği gün sayısı obez olmayan grupta daha yüksekti (2.6 ± 1.3). vs. 3.1 ± 1.9, p= 0.032).

Sonuç: Hastalarımızın elastik kompresyon çorabı ile uyumu %20.7 kadar düşük bulundu. Obez hasta grubunda uyum daha düşüktü. Tek değişkenli lojistik regresyonda uyumsuzlukla ilişkili tek faktör obezite ve diyabetes mellitus idi. Hasta uyum oranını artırmak için daha yüksek hasta popülasyonlarında daha fazla çalışmaya ihtiyaç vardır.

Anahtar Kelimeler: Venöz yetersizlik; kompresyon çorabı; uyum; obezite

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INTRODUCTION

Chronic venous insufficiency (CVI) in the lower extremity is a condition with a high burden of disease, causing pain, weakness, and impaired quality of life[1,2]. The clinical manifestations range from telangiectasia and reticular veins to venous ulcers.

The management of chronic venous insufficiency is well-defined in the 2022 Guidelines of the European Society for Vascular Surgery (ESVS)[3]. Pharmacological agents, exercise, and compression therapy form the basis of conservative treatment[3]. Physical exercises aiming at strengthening the calf muscles and increasing mobility in the ankles are recommended[2,3]. Weight loss is also effective in reducing symptoms[2,4].

The pharmacological agents against CVI act by reducing capillary permeability and inflammatory response and inducing venoconstriction to improve venous tone[2,3]. Elastic compression stockings (ECS) are recommended for symptomatic CVI with a pressure of at least 15 mmHg[3,5]. Compression therapy by ECS relieves symptoms, reduces edema and skin induration, and improves calf muscle pump function[3,5-7]. The proven benefits of ECS also include improving venous hemodynamics as well as relieving the symptoms[3,8].

Despite the many benefits of ECS, patient non-compliance with ECS limits optimal conservative treatment for CVI[9-11]. The factors which impair the patient's compliance could be patient-related or ECS-related[9,10,12]. The risk factors held responsible for patient non-compliance with ECS are the hot climate, complaints such as pain, discomfort, the sensation of heat, and difficulties in putting on or taking off the ECS[9,10,12,13]. Restricted hip and vertebral mobility in obese patients limits the patient's bending and impairs putting on and taking off the ECS. Obesity is also a well-defined risk factor for CVI. The calf pressure while standing increases in obese patients due to larger fat tissue[4,14].

Body mass index (BMI) is a quantitative measurement to determine obesity. The other quantitative measurements associated with higher BMI are ankle, calf, and waist circumferences. In this study, we aimed to investigate the impact of obesity on patient compliance with ECS and to reveal patient behavior-related and compression stocking-related factors for noncompliance.

PATIENTS and METHODS

Study Population

The study is designed as a single-center, cross-sectional study. Patients with lower extremity chronic superficial venous insufficiency who were admitted to the cardiovascular surgery outpatient clinic between July and August 2022 were included in the study. The inclusion criteria were symptomatic lower limb chronic venous insufficiency patients with non-complicated CVI above 18 years old (CEAP= C2S and C3 patients only), patients who have previously been prescribed ECS for at least three months ago, patients without contraindication for ECS (peripheral arterial disease, dermatitis, etc.), patients with the ability to wear ECS without assistance. Patients with lower extremity lymphatic disease, deep venous disease (thrombosis or insufficiency), previous venous intervention (stripping, thermal ablation, etc.), patients who are unable to communicate due to neurocognitive disorders, or non-native speakers were excluded from the study. Four patients did not buy ECS due to the high cost. These patients were excluded from the study. Of 2028 patients admitted to the cardiovascular surgery outpatient clinic within the study period, 246 patients met the inclusion criteria and were included in the study.

The patients were divided into two groups with BMI above and below 30, the value determined for the definition of obesity (BMI≥ 30 vs. BMI< 30).

The ethical approval was obtained from the Ethics Committee of İstanbul Medeniyet University, Faculty of Medicine (Decision no: 2022/0350, Date: 01.06.2022). Informed consent was obtained from the patients. The study procedures adhered to the guidelines of the Declaration of Helsinki.

Definitions

Proper use of ECS is defined as putting on the ECS with elevated legs and not removing them unless the lower extremity elevation was achieved. Patient compliance with ECS is defined as using ECS properly for five days or more in a week. Noncompliance is defined as using ECS for four days or less weekly[15].

Data Collection

Patients were given a questionnaire. The first part of the questionnaire included baseline characteristics of patients such as age, gender, educational status, diabetes mellitus, hypertension, chronic lung disease, medication, and waist, calf, and ankle circumferences. The physician filled out this part of the questionnaire based on the information obtained from the patient.

Assessment of Compliance with Elastic Compression Stockings

The patient compliance with ECS and the factors for noncompliance were questioned in the second part of the questionnaire. Firstly, it was asked whether the patients wore ECS properly every day of the week for the last three months. Patients who did not use ECS properly every day were asked how many days of the week they wore them properly. Subsequently,

the compression stockings-related and patient behavior-related factors for patient noncompliance were questioned. The last question was a single question asking whether the patients were sufficiently informed about the importance of ECS in treating CVI by their physician. The patients filled out the second part of the questionnaire personally to avoid bias.

Statistical Analysis

Jamovi Statistics (version 1.2.27 solid.exe) software was used for statistical analysis. Nominal variables were given as numbers with percentages. Continuous variables were provided as means with their standard deviation. The chi-square test was used to compare the groups for the nominal variables. Independent Samples t-test was used to compare parametric data and the Mann-Whitney U test for nonparametric data. Patient-reported risk factors were compared between groups. Risk factors for patient noncompliance with ECS were included in the univariate logistic regression analysis. Compression stockings-related and patient-related factors for noncompliance with ECS were presented. A p-value of <0.05 was considered statistically significant.

RESULTS

Of the 246 patients included in the study, 22 were male, and 224 were female. The mean age was 49.0 ± 13.1, and the mean BMI was 28.6 ± 5.2. The number of obese patients (BMI≥ 30) was 88 (Table 1). Only 51 patients (20.7%) out of 246 complied with ECS. The mean number of days per week in which the ECS were properly used was 2.9 ± 1.7 in the study population.

The groups were similar in terms of age, gender, smoking, education, and venoactive drugs. The rate of diabetes mellitus and hypertension (p= 0.027 and p= 0.014) were higher in the obese group.

Body measurements such as waist, calf, and ankle circumferences (p< 0.001) were found to be higher in the obese group (Table 2).

Patient compliance with ECS was higher in the non-obese group (12.5% vs. 25.3%, p= 0.017), and the number of days per week in which the ECS was worn properly was higher in the non-obese group (2.6 ± 1.3 vs. 3.1 ± 1.9, p= 0.032) (Table 3).

The effect of diabetes mellitus, hypertension, BMI, and other body measurements on patient compliance with ECS were evaluated with univariate logistic regression analysis (Table 4). Except for obesity (BMI≥ 30), no significant effect of other body measurements on compliance with ECS was observed.

Compression stockings-related and patient-related factors for noncompliance with ECS are presented in Table 5. Sense of squeezing (68.3%), discomfort (65.0%), and difficulty in putting on and taking off (56.1%) were found to be the leading compression stockings-related reasons for noncompliance, according to patients' feedback. On the other hand, patients' laziness was found to be the main patient-related factor for noncompliance.

Table 1. Baseline characteristics of study population

	BMI≥ 30 (n= 88)	BMI< 30 (n= 158)	p
Age	50.9 ± 11.4	47.8 ± 13.8	0.076
Gender (F/M)	146/12	78/10	0.321
DM	25 (28.4%)	26 (16.5%)	**0.027**
HT	33 (37.5%)	36 (22.8%)	**0.014**
Smoking	18 (20.5%=	32 (20.3%)	0.970
Education			
Primary school	4 (4.5%)	9 (5.7%)	
High school	42 (47.7%)	67 (42.4%)	0.705
University	42 (47.7%)	82 (51.9%)	
Venoactive drugs			
Flavonoid complex	50 (56.8%)	89 (56.3%)	
Calcium Dobesilate	32 (36.4%)	46 (29.1%)	0.149
None	6 (6.8%)	23 (14.6%)	

DM: Diabetes mellitus, F/M: Female/male, HT: Hypertension, RF: Radiofrequency, BMI: Body mass index.

Table 2. Body measurements

	BMI≥ 30 (n= 88)	BMI< 30 (n= 158)	p
Height	162.6 ± 7.5	164.0 ± 7.1	0.164
Weight	90.4 ± 10.2	68.3 ± 8.8	**<.001**
Body mass index	34.2 ± 3.4	25.4 ± 2.9	**<.001**
Waist circumference	98.7 ± 7.3	88.5 ± 6.2	**<.001**
Calf circumference			
Right	40.2 ± 4.2	35.0 ± 3.0	**<.001**
Left	39.3 ± 4.7	34.9 ± 3.0	**<.001**
Ankle circumference			
Right	27.8 ± 4.7	24.2 ± 1.7	**<.001**
Left	26.9 ± 2.8	24.1 ± 1.8	**<.001**

BMI: Body mass index.

Table 3. Evaluation of patients' compliance with elastic compression stockings

	BMI≥ 30 (n= 88)	BMI< 30 (n= 158)	p
Compliance with compression stockings*	11 (12.5%)	40 (25.3%)	**0.017**
Number of days the stockings were worn properly per week	2.6 ± 1.3	3.1 ± 1.9	**0.032**

*Proper use of compression stockings for five days or more a week.
BMI: Body mass index.

Table 4. Univariate logistic regression of the risk factors for noncompliance with elastic compression stockings

	Hazard ratio	95% CI	p
Obesity (BMI≥ 30)	2.370	0.138-1.590	**0.020**
DM	3.730	0.245-2.390	**0.016**
HT	1.780	(-0.180)-1.330	0.135
Waist circumference	1.027	(-0.013)-0.066	0.194
Right calf circumference	1.000	(-0.069)-0.077	0.913
Left calf circumference	1.065	(-0.016)-0.142	0.121
Right ankle circumference	0.997	(-0.089)-0.083	0.952
Left ankle circumference	1.145	(-0.004)-0.275	0.057

CI: Confidence interval, DM: Diabetes mellitus, HT: Hypertension.

DISCUSSION

Elastic compression stockings are an essential and effective treatment method that ensures lower extremity venous return[2,3,6]. Their use helps to improve symptoms and reduce edema and skin induration[5,7]. Despite the benefits, the patients do not fully comply with ECS. There are many factors for non-compliance with ECS, including unfavorable aspects of ECS and patient-behavior-related factors[9,10,12]. Obesity is one of the least emphasized factors among these.

In our study population, it was observed that non-compliance with ECS was more common in the obese group (12.5% vs. 25.3%, p= 0.017). Also, the number of days per week in which the ECS were worn properly was lower in the obese

Table 5. Patient-reported reasons for noncompliance with elastic compression stockings

	BMI≥ 30 (n= 88)	BMI< 30 (n= 158)	Overall
Compression stocking-related factors for noncompliance			
Difficult to put on and take off	52 (59.1%)	86 (54.4%)	138 (56.1%)
Worsening symptoms	4 (4.5%)	6 (3.8%)	10 (4.1%)
Squeezing	64 (72.7%)	104 (65.8%)	168 (68.3%)
Uncomfortable	58 (65.9%)	102 (64.6%)	160 (65.0%)
Sensation of hot or burning	0 (0.0%)	4 (2.5%)	4 (1.6%)
Itching, irritating	10 (11.4%)	22 (13.9%)	32 (3.0%)
Takes long time to put on	8 (9.1%)	14 (8.9%)	22 (8.9%)
Unaesthetic	0 (0.0%)	2 (1.3%)	2 (0.8%)
Not helpful	14 (15.9%)	13 (8.2%)	27 (11.0%)
Patient behavior-related factors for noncompliance			
Lazy to wear	40 (45.5%)	84 (53.2%)	124 (50.4%)
Forget to wear	24 (27.3%)	32 (20.3%)	56 (22.8%)
Need a break	18 (20.5%)	24 (15.2%)	42 (17.1%)
Wear at particular times (physical exercise, working, walking etc.)	6 (6.8%)	12 (7.6%)	18 (7.3%)

group (2.6 ± 1.3 vs. 3.1 ± 1.9, p= 0.032). These results arise from undesirable conditions secondary to obesity.

Obesity is a well-known risk factor in the etiology of CVI[2,4,16]. Weight loss has been shown to reduce CVI symptoms effectively[2,4]. It also increases the pump function of the calf muscles, which is essential for lower extremity venous return, as it increases the effort capacity[5,7].

Obesity can make it challenging to put on and take off the ECS as it reduces the spine and hip mobility of the patients[11,13]. In addition, abdominal obesity reduces the bending of the body due to the mass effect. It is known that arthritis increases in the lower extremities and spine joints in obesity[5,11,17,18]. This can be another reason that restricts joint movements, reducing patient compliance with ECS.

When comparing the baseline characteristics between the groups in our study population, no significant difference was observed in terms of age, gender, smoking, education, and venoactive drug use, except for diabetes mellitus and hypertension. Although the difference in diabetes mellitus and hypertension between the groups seems to be a confounding factor, these differences are expected since they are secondary diseases that may be caused by obesity[17,18]. We think that matching the groups in terms of diabetes mellitus and hypertension will not contribute to the aim of the study.

Along with BMI, body measurements, including waist, calf, and ankle circumferences, can also affect patient compliance with ECS[8,13,19]. Higher body measurements are also expected in the higher BMI group. The univariate logistic regression revealed no association of waist, calf, and ankle circumferences with patient compliance with ECS in our study population.

There is no validated scale or questionnaire that can measure the reasons for patients' non-compliance with ECS. Dawson et al., in their randomized controlled trial, presented the patient-reported reasons for non-compliance with ECS in deep venous thrombosis patients[9]. Gong et al. and D. Rastel studied the reasons for patient noncompliance with ECS in CVI patients[10,12]. The questions obtained from these studies and patient-reported risk factors for noncompliance enabled us to create a questionnaire in our study[9,10,12].

As a result of the questionnaire given to the patients, the sense of squeezing (68.3%), discomfort (65.0%), and difficulty in putting on and taking off (56.1%) were found to be the leading compression stockings-related factors for noncompliance. Similar results were found in the study of Dawson et al[9].

Only 51 patients (20.7%) out of 246 complied with ECS in our study population. This figure appears very low when compared with the previous studies. Patient compliance with ECS is around 30-60% in the literature[8,9,20,21]. The poor results

similar to our study population were also found in the study of Ziaja et al.[16] They reported approximately 20% of compliance with ECS in their study population.

We believe there is another critical reason besides the patient-reported ones for the low rate of patient compliance with ECS in our study. The patients may not have understood the importance and efficacy of the ECS adequately.

Limitations

Since our clinic is a large tertiary healthcare institution, patients from many centers apply to our outpatient clinic. Therefore, it is difficult to evaluate whether patients are adequately informed. This is a limitation of our study and could be the subject of another study. Another limitation of the study is that we do not know which brand of ECS the patients use. There is no universal validity of the questionnaire for CVI patients, which itself is a limitation. Nevertheless, we created our questionnaire in light of patient-reported reasons and factors highlighted in previous studies, which increases the scientific value of our research.

CONCLUSION

The compliance of our patients with ECS was found to be as low as 20.7%. Compliance was lower in the group of obese patients. Obesity and diabetes mellitus were the only factors associated with noncompliance with ECS in univariate logistic regression analysis. Body measurements such as waist, calf, and ankle circumference were not found to be associated with noncompliance. Difficulty in putting on and taking off, the sense of squeezing, and discomfort were found to be the leading compression stockings-related factors, and patients' laziness was the main patient-related factor for noncompliance. Further studies are needed in larger patient populations to increase the patient compliance rate with ECS.

Ethics Committee Approval: The ethical approval was obtained from İstanbul Medeniyet University Göztepe Training and Research Hospital Ethics Committee (Decision no: 2022/0350, Date: 01.06.2022). Informed consent was obtained from the patients. The study procedures adhered to the guidelines of the Declaration of Helsinki.

Informed Consent: This is retrospective study, we could not obtain written informed consent from the participants.

Peer-review: Externally peer-reviewed.

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