Body Mass Index and Primary Chronic Venous Disease

Beden Kitle İndeksi ve Primer Kronik Venöz Hastalık

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ABSTRACT Objective: This study aims to evaluate the relationship between severity of venous insufficiency and body mass index (BMI) in patients who were referred for a Doppler ultrasonography examination with clinical diagnosis of chronic venous insufficiency. **Material and Methods:** 200 patients with a complaint of lower extremity venous insufficiency were examined prospectively. The patients were categorized according to the clinical, etiologic, anatomic and pathophysiologic (CEAP) classification. Lower extremity venous Doppler findings were recorded. Fourteen of these patients were excluded due to deep venous thrombosis. The belly/hip ratio and BMI of the remaining 186 were recorded. Presence, duration and rate of reflux, and location and number of segments with reflux were recorded. Three groups were formed according to BMI severity (normal weight: 18.5-24.9 kg/m², overweight: 25-29.9 kg/m², and obese: ≥ 30 kg/m²). These groups were evaluated for CEAP, and presence and severity of reflux. **Results:** There were 61 men (32.1%) and 129 women (67.9%) with a range of age 15-83 (mean: 48.1±12.4) years and BMI range of 19.1-52.0 (mean: 29.8±6.1). No statistically significant relationship was noted among the CEAP categories and BMI groups. There was statistically significant relationship between number of vessels with reflux and CEAP patient groups ($p<0.001$). **Conclusion:** BMI is not associated with severity of venous insufficiency. But the number of veins with reflux is strongly associated with severity of venous insufficiency.

Key Words: Venous insufficiency; body mass index; ultrasonography, doppler

ÖZET Amaç: Bu çalışmada Doppler ultrasonla kronik venöz yetmezlik tanısı alan hastalarda beden kitle indeksi (BKİ) ile venöz yetmezliğin derecesi arasındaki ilişki değerlendirildi. **Gereç ve Yöntemler:** Alt ekstremitede venöz yetmezlik şikayeti olan 200 hasta prospektif olarak değerlendirildi. Hastalar klinik, etiyoloji, anatomi, patoloji (KEAP) sınıflamasına göre kategorize edildi. Alt ekstremite venöz Doppler bulguları kayıt edildi. Ondört hasta venöz tromboz nedeniyle çalışma dışı bırakıldı. 186 hastanın bel/kalça oranları ve BKİ'leri kayıt edildi. Reflü olan segmentlerin sayıları, bölgesi, reflü oranları ve süresi kaydedildi. BKİ'ne göre 3 grup oluşturuldu (normal kilolu: 18,5-24,9 kg/m², kilolu: 25-29,9 kg/m² ve obez: ≥30 kg/m²). Bu gruplar KEAP ve reflünün derecesine göre karşılaştırıldı. **Bulgular:** 15-83 yaşları (ort: 48,1±12,4) arasında 129 kadın (%67,9) ve 61 erkek (%32,1) vardı ve BKİ 19,1-52,0 (ort: 29,8±6,1) arasında idi. BKİ grupları ve KEAP kategorileri arasında istatistiksel olarak anlamlı bir ilişki bulunmadı. KEAP grupları ile reflü olan damarların sayıları arasında istatistiksel olarak anlamlı ilişki vardı ($p<0.001$). **Sonuç:** BKİ venöz yetmezliğin derecesiyle ilişkili değildir. Reflü olan damar sayısıyla venöz yetmezliğin derecesi arasında ise güçlü bir ilişki vardır.

Anahtar Kelimeler: Venöz yetmezlik; beden kitle indeksi; ultrasonografi, doppler

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The complaints secondary to lower extremity chronic venous disease (CVD) are indicators of a very important health problem, which results in substantial loss of work power. The chronic venous insufficiency (CVI) can be either primary or secondary. There is no identifiable cause in primary CVI; however the secondary CVI usually originates from prior deep vein thrombosis (DVT).[1-3]

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The role of obesity is not clear in venous insufficiency, which is considered as multifactorial.[4-7] The obesity is considered an important risk factor not only for the first attack but also for the recurrent episodes of DVT, which is the most important secondary reason of chronic venous insufficiency. This is either due to increased intraabdominal pressure and stasis in the leg veins or due to alterations in coagulation system via disordered fibrinolytic activity and increased plasma concentrations of coagulation factors which leads to DVT.[8-10]

In this study our aim was to investigate the impact of obesity on primary chronic venous disease.

MATERIAL AND METHODS

In our study, we have included 200 patients (139 women and 61 men) who applied to vascular surgery clinic of our hospital with symptoms and signs of lower extremity chronic venous insufficiency (CVI). The patients with known history of DVT or acute DVT were excluded. The patients were classified by the vascular surgeon from 1 to 6 according to their venous insufficiency findings using clinical, etiologic, anatomic and pathophysiologic (CEAP) categories.[11]

Colour Doppler ultrasonography (DU) of the lower extremity veins was performed on every single patient using GE Logic 9; USA machine. The DU examinations were performed in supine position with the upper body at 10 degree of elevation. Deep venous system (including common femoral vein, deep and superficial femoral veins, and popliteal vein) and superficial venous system (including saphenofemoral junction, vena saphena manga, and vena saphena parva) of each extremity were examined.

A reverse flow exceeding 0.5 s was assumed to be pathologic on Doppler examination. The duration and severity of a reflux flow were recorded for each patient. The number of venous segments with reflux flow were also counted and classified. In this classification, the VSM was divided into two segments as upper and lower leg part. The other veins such as superficial, gastrocnemial and soleal like muscular veins and perforating venous structures are classified as "the others." The severity of CVD was graduated to the number of insufficient anatomical venous segments of lower extremities (1-7 anatomical segments)(Table 1).[11]

Additionally, the demographic data including age, sex, height, weight, BMI, belly circumference, hip circumference, belly/hip ratio was also recorded (Table 2). The patients were divided into three categories according to their age (15-40, 40-65, and 65 years and above) and according to their BMI values (normal weight: 18.5-24.9 kg/m^2, overweight: 25-29.9 kg/m^2 and obese: ≥30 kg/m^2) (WHO, 2004).[12] Oral and written informed consents were received from all patients. Study protocol was approved by institutional ethics committee.

STATISTICAL ANALYSIS

The statistical analysis was performed using IBM SPSS for Windows Version 21.0. Numerical variables were summarized as mean±standard deviation or median [Min-Max] and the categorical variables were summarized as numbers and per-

TABLE 1: Anatomical segments with reflux flow.

1	Common femoral vein
2	Femoral vein
3	Popliteal vein
4	Great saphenous vein above knee
5	Great saphenous vein below knee
6	Small saphenous vein
7	Nonsaphenous veins

TABLE 2: Demographic variables.

	Mean±Sd	Min–Max
Age	48.1±12.4	15–83
Height	1.64±0.09	1.40–1.87
Weight	79.9±15.9	50–127
BMI	29.8±6.1	19.13–52.03
Waist	98.5±14.1	66–144
Hip	112.6±12.5	88–152
Waist/hip	0.86±0.09	0.67–1.18

Sd; Standard deviation, Min; Minimum, Max; Maximum, BMI;Body mass index.

centages. Mann Whitney U test and student T test were utilized to compare the numerical variables between independent groups depending on whether the parametric test assumptions were met or not. Kruskal Wallis test was utilized for the comparison of multiple groups. Chi square test or Fishers Exact test were utilized to compare the groups with categorical variables. A p value of <0.05 was considered to be statistically significant.

RESULTS

200 patients (139 women and 61 men) were examined. Fourteen of the initial 200 cases were excluded due to current positive findings on Doppler US suggestive of chronic DVT. The remaining 186 patients (314 extremities) between ages of 15 to 83 years (mean age of 48.1) were included in the study. The mean BMI was 29.8±6.1 kg/m^2 (range: 19,1-52,0). The most frequent CEAP class was C3 (99 legs, 31.5%) followed by C2 (83 legs, 26.5%) (Table 3). 17.5% of the patients showed no venous segment with reflux flow while 31.2% of the patients demonstrated single venous segment with reflux flow. On the other hand, 0.3% of the patients had 7 venous segments with reflux flow (Table 4).

There was no statistically significant association between CEAP categories and BMI groups (Table 5).

There was no statistically significant relationship between BMI and clinical CEAP C categories or segments with reflux flow on Duplex US (P=0.616) (Figure 1). However there was a statistically significant relationship between CEAP C categories and number of the segments with reflux (p<0.001). The number of segments with reflux was higher in groups of CEAP C2, 3, 4, 5 and 6 compared with CEAP C1.

TABLE 3: Distribution of patients according to the clinical CEAP classification.

	Frequency	Percent (%)
CEAP 1	61	19.4
CEAP 2	83	26.5
CEAP 3	99	31.5
CEAP 4	56	17.8
CEAP 5	9	2.9
CEAP 6	6	1.9

CEAP; Clinical, etiologic, anatomic and pathophysiologic categories.

TABLE 4: The number of insufficient venous segments.

Number of insufficient venous segments	Frequency	Percent (%)
0	55	17.5
1	98	31.2
2	78	24.8
3	42	13.4
4	25	8.0
5	9	2.9
6	6	1.9
7	1	0.3
Total	314	100

The reflux flow in SF junction had a positive association with BMI, CEAP C2-6 and number of segments with insufficiency; however, it was not related to belly circumference, belly/hip ratio or CEAP C1 categories. The reflux flow at saphenopopliteal segment was not associated with BMI, belly circumference or belly/hip ratio.

DISCUSSION

It has been demonstrated in multiple studies that there is a relationship between obesity and chronic venous disease especially with advanced venous insufficiency clinical situations such as C 4, 5, 6. Vlajinak et al. have noted that CEAP 3-6 categories are frequently seen in obese patients independent of age, sex and the other postulated factors; however, when the CEAP 0, 1, 2 categories were included, there was no relationship between the BMI and all patients with varicous veins.[9] Additionally they have noted that DVT is more likely to be seen in obese and overweight patients relative to the normal weight patients; but venous obstruction is not an independent variable in CEAP C category and in obesity.

On the other hand, Carpentier et al. could not find a statistically significant relationship between being overweight and chronic venous disorders of the legs in their population based study in which

TABLE 5: Relations of BMI and CEAP patient groups.

	BMI 0-25 (n=36)	BMI 25-30 (n=107)	BMI ≥ 30 (n=171)	p
Ceap 1	5 (14%)	18 (17%)	38 (23%)	0.407
Ceap 2	6 (17%)	35 (32%)	42 (25%)	0.719
Ceap 3	8 (22%)	34 (32%)	57 (33%)	0.453
Ceap 4	13 (36%)	17 (16%)	26 (15%)	0.622
Ceap 5	3 (8%)	2 (2%)	4 (2%)	0.543
Ceap 6	1 (3%)	1 (1%)	4 (2%)	0.494

BMI; Body mass index, CEAP; Clinical, etiologic, anatomic and pathophysiologic categories.

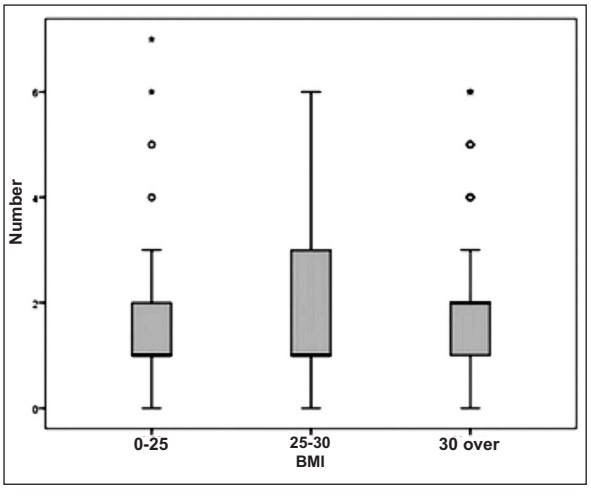

FIGURE 1: Relations of BMI and the number of insufficient venous segments.

patients with a history of thromboembolism were included.[13] Seide et al. have reported a statistically significant relationship only in women between BMI and clinical classification.[14] Similar to these studies in our study we could not demonstrate any significant relationship in CVI patients between CEAP 1-6 clinical groups and BMI.

It has been considered that increased body weight is related to CVI. The reasons might be the mass effect which results in venous stasis, activity restrictive effect of obesity, or alterations in coagulation system such as impaired fibrinolytic activity and increased plasma concentrations of coagulation factors contributing to the formation of thrombus.[8-10]

It is not clear why some of the studies find that obesity and CVI are related to each other in men and women while the other studies suggest that such relationship is seen only in women. Our study cannot demonstrate any significant relationship between these two variables which suggest that the mechanism of effect of obesity on lower extremity venous system. Additionally, primary varicosity of veins can be seen in young adults regardless of any other identifiable reason such as sex, obesity, and age.[15]

The significant relationship between the clinical CEAP classification and the number of vessel segments which demonstrate reflux flow ($p<0.001$) in our study have proven that the clinical progression of chronic venous insufficiency goes along with pathophysiological progression. However, neither the CEAP 1-6 groups nor the number of veins with reflux flow on Doppler examination was not associated with belly circumference or BMI.

CONCLUSION

In our study that investigates the relationship between primary chronic venous insufficiency and obesity, we were able to demonstrate the clinical and pathophysiological association, but we were not able to find any positive correlation between the lower extremity chronic venous insufficiency and increased body weight. We might have come to this conclusion due to the exclusion of the patients with current or past venous thromboembolism that could be predisposed secondary to obesity. However, we think that the relationship between increased weight and primary chronic venous insufficiency has not been investigated sufficiently.

Further investigation is necessary to clarify the relationship of the BMI and CVI in larger patient population with more complete clinical data set

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