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VASC ENDOVASCULAR SURG 2002 36: 271

DOI: 10.1177/153857440203600404

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The Influence of Obesity on Chronic Venous Disease

Gudmundur Danielsson, MD,* Bo Eklof, MD, PhD,[†] Andrew Grandinetti, PhD,[‡] and Robert L. Kistner, MD,[†] *Honolulu, HI*

The authors investigate the impact of overweight in patients with chronic venous disease and determine if the eventual effect can be explained by increased venous reflux alone. Patients with chronic venous disease who underwent duplex-ultrasound scanning at the Vascular Center, Straub Clinic and Hospital during 1999 were classified according to the clinical, etiologic, anatomic, and pathophysiologic (CEAP) system and body mass index (kg/m²) was calculated. Reflux duration was measured in seconds and peak reverse flow velocity in cm/second. Multi-segment reflux score (total score) was calculated for both reflux duration and peak reverse flow velocity. The reflux pattern and body mass index were correlated to the clinical presentation. Four hundred and one lower extremities (204 right, 197 left) in 272 patients (173 female) with a mean age of 60 years (range 14–90) were investigated. The mean body mass index was 28.9 (±7.76). One hundred sixty-seven patients (61%) were overweight (body mass index 25 kg/m² or more). There was a significant association between body mass index and the clinical severity ($p < 0.001$). This association persisted after adjustments for total peak reverse flow velocity and total reflux score were made ($p < 0.001$). Overweight patients were more likely to have skin changes and ulceration ($p < 0.001$) than patients with a body mass index less than 25 kg/m², despite similar values for total reflux time ($p = 0.92$) and total peak reverse flow velocity ($p = 0.98$). There was an ethnic difference, with Pacific Islanders being significantly heavier and younger compared to patients of white, Asian and Filipino ancestries. The variations in the frequency of skin changes were consistent with ethnic differences in body mass index. The correlation of body mass index with clinical severity independent of reflux measurements indicates that the effect of overweight may involve a mechanism separate from local effects on venous flow. **Overweight appears to be a separate risk factor for increased severity of skin changes in patients with chronic venous disease.**

Introduction

Controversies exist about the role of overweight in chronic venous disease (CVD).¹ The World Health Organization (WHO) classifies overweight as a body mass index (BMI) 25 to 29 kg/m² and obesity as a BMI of 30 kg/m² or more. **The association between obesity and varicose veins has been confirmed, especially in women.**² The role of overweight and obesity in the more severe stages of CVD is not well established. In a population study by Nelzen et al,³ patients with venous

Vasc Endovasc Surg 36:271–276, 2002

From the *Straub Foundation and John A. Burns School of Medicine, Department of Surgery, University of Hawaii; [†]Straub Clinic and Hospital; and [‡]Pacific Biomedical Research Center, University of Hawaii, Honolulu, HI

Correspondence: Gudmundur Danielsson, MD, Department of Vascular Diseases, University Hospital MAS, S-205 02 Malmö, Sweden
E-mail: gudmundurdanielsson@yahoo.com

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ulcer had a significantly higher median BMI compared to patients with nonvenous ulcer and compared to the adult Swedish population. A study by Westling et al⁴ reported a low incidence of duplex ultrasound-measured deep venous reflux in patients scheduled for obesity surgery. In a case-control dual study from 1995 by Scott et al,⁵ an adjustment for differences in age using multivariate analysis showed a relationship between obesity and men with chronic venous insufficiency. A study by McColl et al⁶ could not verify any correlation between development of post-thrombotic syndrome and BMI in 43 young women with a single episode of deep vein thrombosis. The effect of increased BMI on clinical severity of CVD and how this effect can be explained is unknown.

Patients and Methods

Four hundred and one lower extremities with CVD were investigated with duplex ultrasound scanning during 1999 at the Vascular Center, Straub Clinic and Hospital (Figure 1). The group consisted of 272 patients (173 females) with a mean age of 60 years (range 14–90 years) (Table I). Four main ethnic groups were identified. Patients with white and Asian (mainly Japanese

and Chinese) ancestry were the most common. Pacific Islanders, including native Hawaiian, were the third largest group, followed by Filipinos. Patients with mixed ethnicity, or where ethnicity could not be determined, formed the fifth group (Figure 2).

All segments in superficial and deep veins were investigated. The occurrence of incompetent perforator veins was noted. The scan was performed in a 15° reverse Trendelenburg position. Reverse venous flow was induced with the Valsalva maneuver for veins above the knee, and calf compression/release for veins below the knee. Reflux time was measured in seconds, with reflux time exceeding a half second defined as pathological. Peak reverse flow velocity was measured in cm/second. Reflux time and peak reverse flow velocity were graded from 0 to 4 in accordance with the current practice at the Vascular Center, Straub Clinic and Hospital (Table II). Total reflux time and total peak reverse flow velocity were calculated for each leg by adding values from each diseased segment. Values from 3 superficial venous segments (greater saphenous vein above the knee, greater saphenous vein below the knee, and lesser saphenous vein) and 4 deep venous segments (common femoral vein, superficial femoral vein, deep femoral vein, and popliteal vein) were used. As we lack standardization for measuring reflux in crural veins and

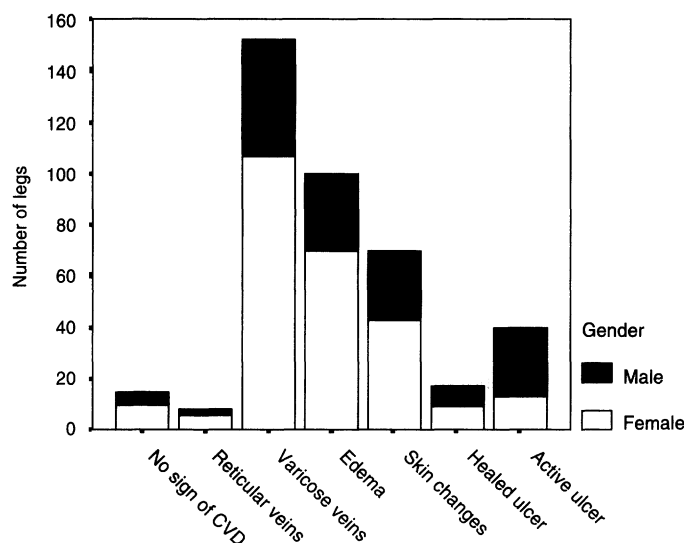


Figure 1. Clinical class (CEAP) in 401 legs examined with duplex scanning.

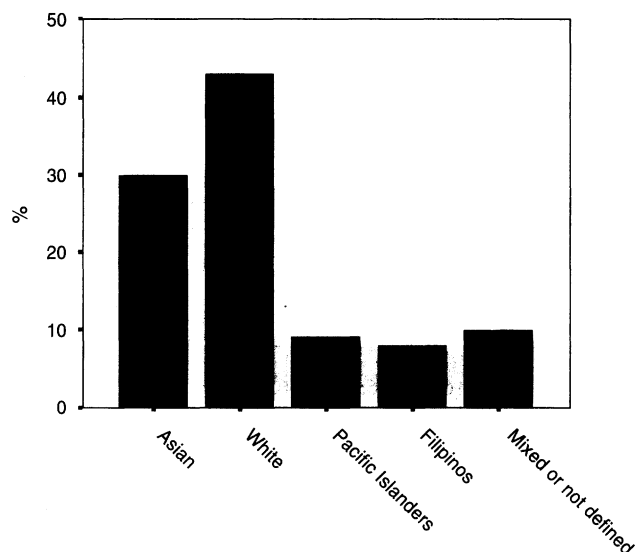


Figure 2. Ethnic groups.

Table I. Demographic data, value as mean (\pm SD).

	Male (143 legs)	Female (258 legs)	
Age, yr (\pm SD)	59 (\pm 15.2)	61 (\pm 15.0)	
BMI (\pm SD)	30.8 (\pm 8.3)	27.9 (\pm 7.4)	p<0.005
Clinical classification (CEAP)	3.4 (\pm 1.6)	2.8 (\pm 1.3)	p<0.005

Table II. Grading reflux time and peak reverse flow velocity.

Grade	Reflux Time	Grade	Reverse Flow Velocity
0	<0.5 second	0	0
1	>0.5, <1.0 second	1	<10 cm/second
2	>1.0, <2.0 second	2	10–20 cm/second
3	>2.0, <3.0 second	3	20–30 cm/second
4	>3.0 second	4	>30 cm/second

perforator veins, we decided to omit these veins in the calculation of total reflux time and total peak reverse flow velocity. Patients were classified according to the clinical, etiologic, anatomic, and pathophysiologic (CEAP) classification and BMI (kg/m^2) was calculated. The Mann-Whitney test was used for comparing differences in mean, p value less than 0.05 was considered as significant. We calculated odds ratio (OR) with 95% confidence intervals as estimates of the relative risk of developing skin changes using logistic regression analysis. All statistical analysis was performed using the JMP version 4.0 (SAS Institute, USA) and SPSS version 10.1 (SPSS Inc, USA) statistical package.

Results

The mean BMI was 28.9 (\pm 7.76). One hundred sixty-six patients (61%) were overweight (BMI \geq 25 kg/m^2) and 82 (30%) were obese (BMI \geq 30 kg/m^2). There was a significant association between BMI and clinical severity (Pearson's correlation = 0.3, p < 0.001). This association persisted after the adjustment for total peak reverse flow velocity and total reflux score (p < 0.001). Overweight patients (BMI \geq 25 kg/m^2) were more likely to have skin changes and ulcers (p < 0.001) than patients with a BMI of less than 25 kg/m^2 despite similar values for total reflux time (p = 0.92) and total peak reverse flow velocity

($p = 0.98$). The odds ratio for skin changes was significantly increased with a BMI of 25 kg/m² or more (OR 2.4 95% CI, 1.5–3.9). The odds ratio was more profound in patients with a BMI greater than 40 kg/m². (OR 7.4 95% CI, 3.2–16.9). The presence of incompetent perforators was more often noted in the heavier group ($p = 0.003$). There was no significant difference in BMI between patients with primary or secondary disease ($p = 0.08$), or between patients with or without deep venous reflux extending from superficial femoral vein to popliteal vein below the knee ($p = 0.95$).

The anatomic distribution of disease and median BMI for each anatomic group is presented in Table III. Fifteen percent of patients with varicose veins were obese compared to 58% of patients with open venous ulcer (Figure 3). There was a difference in BMI between ethnic groups, and all of them had mean BMI above the normal as defined by the WHO (Table IV). Pacific Islanders were significantly heavier than the other ethnic groups ($p < 0.001$).

The prevalence of skin changes appeared to differ significantly by ethnic group (Figure 4), with the lowest frequency observed among Filipinos (15.6%) and highest among Pacific Islanders (56.8%), which were the two groups with the lowest and highest average BMI, respectively. However, when multiple logistic regression was used to estimate the association between eth-

nicity and skin changes after controlling for age, gender and BMI, the association was no longer significant (data not shown).

Discussion

The prevalence of overweight condition in North America has increased dramatically during the past decades, and is reported to be as high as 65%.⁷ The population of Hawaii is a mixture of many different ethnic groups, mainly people of white, Japanese, Chinese, Filipinos or native Hawaiian ancestry. Other investigators have reported significant differences in BMI among females in these ethnic groups, with native Hawaiians and Filipinos having significantly higher BMI compared to white and Japanese.^{8,9} Likewise, Pacific Islander patients (including Hawaiians) in our study had the highest average BMI as a group; however, in contrast to earlier studies, Filipino patients in our study had the lowest average BMI as a group. Apparently, the difference in BMI accounted for the ethnic disparities in the frequency of skin changes in this population.

The cause of venous ulcers might be multifactorial and to only deal with the venous incompetence might not explain some of the recurrence

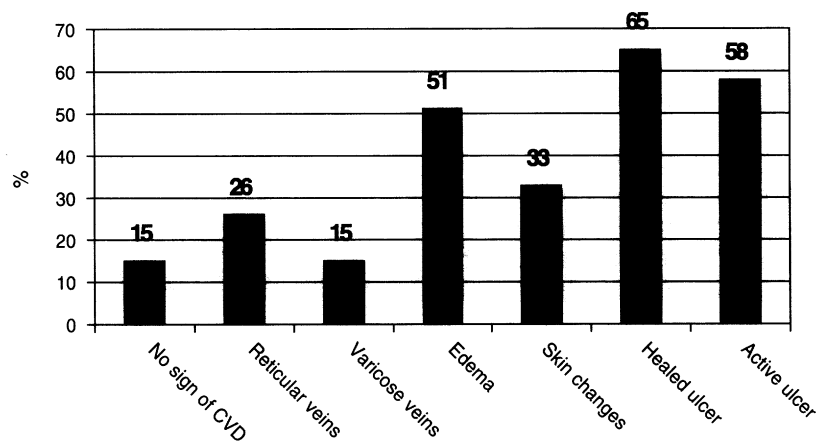
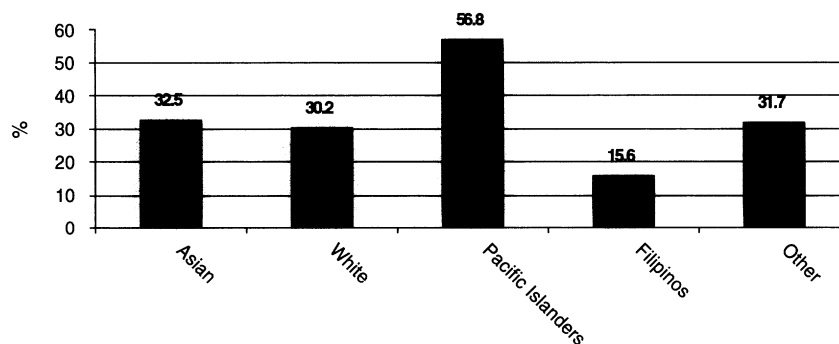
Table III. Anatomical distribution of disease, number of extremities in each group and mean BMI (\pm SD).

Anatomical Distribution	Legs	Mean BMI	(SD)
Superficial only	28	26.9 kg/m ²	(± 6.8)
Perforator only	18	32.5 kg/m ²	(± 7.2)
Deep only	14	25.6 kg/m ²	(± 5.3)
Superficial and perforator	111	28.7 kg/m ²	(± 8.5)
Deep and perforator	22	33.0 kg/m ²	(± 10.3)
Superficial and deep	22	25.7 kg/m ²	(± 5.8)
Superficial, deep and perforator	186	29.1 kg/m ²	(± 7.5)

Table IV. Ethnicity and mean BMI for 401 legs with chronic venous disease.

	Legs	Mean Age	Mean BMI	(SD)
Asian*	120	65	26.6 kg/m ²	(±5.3)
White	172	62	28.3 kg/m ²	(±6.2)
Pacific Islanders†	37	55	38.3 kg/m ²	(±11.8)
Filipinos	32	49	25.7 kg/m ²	(±6.2)
Mixed ethnicity or unknown	40	55	31.8 kg/m ²	(±9.3)

*Mainly Japanese and Chinese ancestry. †Native Hawaiian and other Pacific Islanders.

**Figure 3.** Frequency of obesity (BMI ≥ 30 kg/m²) in each clinical class.**Figure 4.** Frequency of skin changes among the five major ethnic groups in the study population.

following surgical treatment of venous conditions. Increased abdominal pressure, as is seen in obese patients, has been implied as a causative factor in CVD. Sugerman et al¹⁰ found a correlation between increased intra-abdominal pressure and venous stasis. We had findings that confirmed the relationship between femoral venous pressure and indirect measured intra-abdominal pressure (bladder pressure). In this study, 15 morbidly obese patients (mean BMI of 50.2 kg/m²) were investigated. Indirectly measured intra-abdominal pressure (mean 19.1 cm H₂O) corresponded to femoral venous pressure in the supine position (mean 19.7 cm H₂O). This was significantly higher compared to the normal controls who had a mean BMI of 24.8 kg/m², mean bladder pressure of 8.5 cm H₂O, and mean femoral venous pressure of 7.5 cm H₂O (unpublished data). Other factors, such as lack of physical activity in overweight persons, could play a part by restricting the venous emptying of the leg. Compression therapy, which lowers the venous hypertension, is certainly more difficult to apply effectively to large legs and that could contribute to a higher incidence of more severe disease in overweight patients.

Is weight reduction going to improve the clinical severity? The condition of the lower leg in patients with CVD has been shown to improve following weight reduction.¹¹ The importance of weight reduction in affected patients should be emphasized before venous surgery is planned.

In the present study, the males more often had secondary disease, higher total peak reverse flow velocity score, and open venous ulcers than females. Some explanation for this could be the higher BMI seen in males. Welch et al¹² had similar findings regarding gender and severe CVD with over-representation of males. They put forward, as an explanation, decreased treatment compliance in males, or the possibility that men do not seek medical attention until ulceration appears. They did not report any gender difference regarding reflux and they did not report BMI.

Conclusions

Our findings suggest that the overweight condition might be an independent risk factor for skin changes in patients with CVD, and that variations in BMI may play a role in manifestations of CVD in different ethnic groups. This correlation of BMI

with the clinical severity independent of venous reflux measurements indicates that overweight might be a cause for disease progression, independent of the effect of reversed venous flow.

REFERENCES

1. Kurz X, Kahn SR, Abenhaim L, et al: Chronic venous disorders of the leg: Epidemiology, outcomes, diagnosis and management. *Int Angiol* 18:83-102, 1998.
2. Brand F, Dannenberg A, Abbott R, et al: The epidemiology of varicose veins: The Framingham study. *Am J Prev Med* 4:96-101, 1988.
3. Nelzen O, Bergqvist D, Lindhagen A: Venous and non-venous leg ulcers: Clinical history and appearance in a population study. *Br J Surg* 81:182-187, 1994.
4. Westling A, Bostrom A, Gustavsson S, et al: Lower limb deep venous incompetence is rare in patients undergoing obesity surgery. *Phlebology* 15:30-32, 2000.
5. Scott TE, LaMorte WW, Gorin DR, et al: Risk factors for chronic venous insufficiency: A dual case-control study. *J Vasc Surg* 22:622-628, 1995.
6. McColl MD, Ellison J, Greer IA, et al: Prevalence of the post-thrombotic syndrome in young women with previous venous thromboembolism. *Br J Haematol* 108:272-274, 2000.
7. Kuczmarski RJ, Flegal KM, Campbell SM, et al: Increasing prevalence of overweight among US adults. The National Health and Nutrition Examination Surveys, 1960 to 1991. *JAMA* 272:205-211, 1994.
8. Aluli NE: Prevalence of obesity in a Native Hawaiian population. *Am J Clin Nutr* 53(6 suppl):1556-1560, 1991.
9. Novotny R, Davis J, Ross P, et al: Adiposity and blood pressure in a multiethnic population of women in Hawaii. *Ethn Health* 3:167-173, 1998.
10. Sugerman H, Windsor A, Bessos M, et al: Intra-abdominal pressure, sagittal abdominal diameter and obesity comorbidity. *J Int Med* 241:71-79, 1997.
11. Melissas J, Christodoulakis M, Spyridakis M, et al: Disorders associated with clinically severe obesity: Significant improvement after surgical weight reduction. *South Med J* 91:1143-1148, 1998.
12. Welch HJ, Young CM, Semegran AB, et al: Duplex assessment of venous reflux and chronic venous insufficiency: The significance of deep venous reflux. *J Vasc Surg* 24:755-762, 1996.