

Evaluation of arterial circulation using the ankle/brachial blood pressure index in patients with chronic venous ulcers*

*Avaliação da circulação arterial pela medida do índice tornozelo/braço em doentes de úlcera venosa crônica**

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Abstract: BACKGROUND - Chronic venous ulcers are extremely frequent and have a significant impact on quality of life and work productivity of individuals, in addition to high costs to public health.

OBJECTIVES - Detection of arterial circulation alterations in chronic venous ulcer legs using a non-invasive method to discriminate patients not indicated to have compressive treatment.

METHODS - Forty patients with chronic venous ulcers were investigated for the presence of peripheral arterial disease with measurement of the ankle/brachial index by Doppler ultrasound.

RESULTS - The resting ankle/brachial pressure index was abnormal (lower than 1) in 9/22 (40.9%) patients with concomitant chronic venous ulcers and hypertension and only in one out of 13 (7.7%) patients with chronic venous ulcers and no hypertension.

CONCLUSIONS - Patients with concomitant chronic venous ulcer and hypertension should be routinely evaluated with the ankle/brachial pressure index to detect a possible association with peripheral arterial disease.

Keywords: Arterial occlusive diseases; Ultrasonography, doppler; Varicose ulcer

Resumo: FUNDAMENTOS – As úlceras venosas dos membros inferiores são freqüentes e têm grande impacto na qualidade de vida e produtividade do indivíduo, além de alto custo para a saúde pública.

OBJETIVOS – Detecção de alterações arteriais em pacientes de úlcera venosa crônica dos membros inferiores com emprego de método não invasivo, de modo a discriminar aqueles em que estaria contra-indicado o tratamento compressivo.

MÉTODOS – Foram estudados 40 doentes portadores de úlcera venosa crônica, com o intuito de se avaliar a presença de doença arterial periférica pela medida do índice tornozelo/braço por doppler-ultra-som.

RESULTADOS – O índice tornozelo/braço mostrou-se alterado (menor que 1) em 9/22 (40,9%) doentes com úlcera venosa crônica e hipertensão arterial concomitante, e apenas em 1/13 (7,7%) doentes de úlcera venosa crônica sem hipertensão arterial.

CONCLUSÃO – Doentes de úlcera venosa crônica e hipertensão arterial concomitantes devem ser submetidos rotineiramente à medida do índice tornozelo/braço para detecção de possível insuficiência arterial periférica associada.

Palavras-chave: Arteriopatias oclusivas; Ultra-sonografia doppler; Úlcera varicosa

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Conflict of interest: None

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INTRODUCTION

Lower limb ulcers are very frequent all over the world and they carry a high medical-social importance since they are extremely debilitating and significantly affect the patient productivity and quality of life, in addition to incurring marked expenses to the health services.¹

The three main types of ulcers in the lower limbs include venous ulcers, arterial ulcers and neuropathic ulcers.² Venous ulcers are the most common type and represent 80% of ulcers in lower limbs with an overall prevalence ranging between 0.06 and 3.6%.³⁻⁶ The most common and important cause of ulcers in the lower limbs is chronic venous insufficiency, followed by arterial disease which represents 10 to 25% of all ulcers and may coexist with venous disease.²⁻⁴

Most venous ulcers are treated with some type of compression (compressive bands/Unna boots); thus, if patients present any arterial insufficiency, this commonly used treatment will be of little benefit and may also delay the healing process of an ulcer and cause greater damage, such as more pronounced ischemia in the affected limb.

There are very few studies evaluating the arterial involvement in patients with venous ulcers, but so far none of them has been published in Brazil which grants the performance of this study.

PATIENTS AND METHODS

This study was performed at the Dermatology Outpatient's Clinic of the Hospital das Clínicas da Faculdade de Medicina da Universidade de São Paulo, between 2003 and 2004.

A total of 40 patients (Tables 1, 2 and 3) with chronic venous ulcers were studied; the inclusion criterion was age above 45 years since the purpose was

TABLE 1: Sample of 40 patients with chronic venous ulcer by sex, age and skin color

Parameters	n%
Sex	
Female	32 (80)
Male	8 (20)
Age	
45-50 (years)	2 (5)
51-60 (years)	9 (22.5)
61-70 (years)	14 (35)
71-80 (years)	14 (35)
> 80 (years)	1 (2.5)
mean (SD) – (years)	66 (8)
Skin color	
Caucasian	29 (72.5)
Black	11 (27.5)

TABLE 2: Variables analyzed in chronic venous ulcers

Site	n (%)
Lateral	10 (25)
Medial	12 (30)
Anterior	2 (5)
Foot	1 (2.5)
Múltiple (more than one site)	15 (37.5)
Size	
1-5cm	24 (60)
6-10cm	7 (17.5)
> 10cm	9 (22.5)
Number	
Single	25 (62.5)
Múltiple	15 (37.5)
Recurrence	
No recurrence	7 (17.5)
Once	11 (55)
> 1 time	22 (27.5)
Duration	
< 1 year	3 (7.5)
1 – 5 years	5 (12.5)
6 – 10 years	7 (17.5)
11 – 15 years	6 (15)
16 – 20 years	9 (22.5)
> 20 years	10 (25)

to evaluate such patients in regard to presence of peripheral arterial disease; the prevalence of the latter condition increases with ageing and it is practically absent in patients aged under 40 years.⁷ The study was carried out during the weekly dressings and patients were evaluated with a questionnaire about risk factors for peripheral arterial disease. The ulcers were clinically evaluated and recorded as to number, size, location, recurrence, onset of lesions and concomitant skin abnormalities. Patients were then evaluated for arterial blood pressure with palpation of dorsalis pedis, posterior tibial and popliteal pulses, as well as the arterial pulses in both arms to identify the stronger pulse on palpation. Next, ultrasound contact gel was applied and the respective blood pressures in the arms and ankles were measured (Figure 1) to obtain the ankle/brachial index (ABI) (Chart 1). The measurement of systolic blood pressure in the ankle and arm was performed by a 5MHz ultrasonography; a systolic ankle/brachial index ≥ 1.0 was considered normal.

The group of patients considered to have arterial insufficiency (ABI <1) was confronted with the other group of patients with a normal ABI (ABI ≥ 1) in terms of clinical data and risk factors for peripheral arterial disease, with analysis of all clinical features related with the venous ulcers previously mentioned.

The study was performed with non-invasive methods without any risks to patients and it was

TABLE 3: Risk factors for peripheral arterial disease (PAD) in patients with chronic venous ulcer

Risk factors for PAD	n (%)
Arterial hypertension	25 (62.5)
Angina/acute myocardial infarction	6 (15)
Smoking	5 (12.5)
Diabetes	4 (10)
Dyslipidemia	-
Ankle/brachial index	
< 1	10 (25)
≥ 1	25 (62.5)
Not assessed	5 (12.5)

approved by the Research Ethics Committee of the Hospital das Clínicas da FMUSP.

As to statistical analysis, the Fischer's exact test and the chi-square test were used to calculate tables and to study variables.

RESULTS

From a total of 40 patients studied (Tables 1, 2 and 3), 32 (80%) were females and 8 (20%) were males. Two (5%) patients were aged 45-50 years, 9 (22.5%) were 51-60 years, 14 (35%) were 61-70 years, 14 (35%) were 71-80 years and 1 (2.5%) was > 80 years. As to skin color, 29 (72.5%) were Caucasian and 11 (27.5%) were Black. The ulcers were located in the lateral region of the ankle in 10 (25%) patients, in the medial region of the ankle in 12 (30%), in the anterior portion of the foot in 2 (5%), in the foot in 1 (2.5%) patient and 15 (37.5%) patients presented more than one affected site (multiple ulcers). The ulcer size varied 1-5 cm in 24 (60%) patients, 6-10 cm in 7 (17.5%) and they were larger than 10 cm in 9 (22.5%).

**FIGURE 1:** Measurement of the ankle/brachial index (ABI)**CHART 1:** Measurement of the ankle/brachial index (ABI) by Doppler ultrasound

$$ABI = P_t/P_b$$

Where:

- ♦ P_t = greater arterial pressure measured in the artery of the limb affected by the ulcer.
- ♦ P_b = greater arterial pressure measured in one arm

A total of 25 (62.5%) patients presented a single ulcer, whereas 15 (37.5%) had multiple ulcers. As to recurrence of ulcers, 22 (27.5%) patients had more than one recurrence, 11 (55%) presented only one recurring episode and in 7 (17.5%) patients the ulcers never healed.

The duration of ulcers was less than one year in 3 (7.5%) patients, 1-5 years in 5 (12.5%), 6-10 in 7 (17.5%), 11-15 years in 6 (15%), 16-20 years in 9 (22.5%) and > 20 years in 10 (25%). The analysis of risk factors for peripheral arterial disease (PAD) showed that 25 (62.5%) patients presented arterial hypertension, 6 (15%) had already suffered an acute myocardial infarction (acute MI) and/or angina, 5 (12.5%) patients were or had been smokers in the past, 4 (10%) patients had diabetes mellitus and none presented dyslipidemia. Regarding measurement of the ankle/brachial index to detect arterial insufficiency, 10 (25%) patients showed some degree of arterial insufficiency ($ABI < 1$), 25 (62.5%) had a normal ABI and in 5 (12.5%) subjects the measurements could not be performed.

The results of ABI analysis as compared to the variables sex, age, skin color, location, size and number of ulcers, number of recurrences and duration of ulcers, history of angina/acute myocardial infarction, presence of diabetes *mellitus* and smoking habit did not show a statistically significant difference.

As to arterial hypertension (Table 4), ABI was abnormal in 40.9% (9/22) of patients who had arterial hypertension (AH) and in only 7.7% (1/13) of patients who did not have AH; thus, there was a statistically significant difference between the ratios.

DISCUSSION

The ankle/brachial index is a non-invasive method used in the medical practice to detect arterial insufficiency.^{3,8} This exam is based on the measurement of arterial pressure in the ankle and arm by using a sphygmomanometer and a portable Doppler ultrasound.

Patients with an ABI ≥ 1 are considered normal and in general they are asymptomatic; patients with an ABI between 0.7 and 0.9 have mild arterial insufficiency and may present intermittent claudication; those with an ABI between 0.5 and 0.15 show a moderate to severe degree of arterial insufficiency and may present pain at rest; patients with an ABI < 0.15 have severe arterial insufficiency accompanied by necrosis and there is a risk of amputation of the affected limb. An ABI < 0.8 is used as a cut-off value to contraindicate the high compression therapy in face of the risk of necrosis of the affected limb.^{9,10} The AIB cut-off value of 0.8, although arbitrary, has been accepted by numerous authors as a final cut-off point for compressive therapy.^{9,10} Cornwall,¹⁰ one of the authors in charge of the first studies proposing the association between ABI and the indication or not for compressive therapy, considered that any ulcer in a limb with an ABI < 0.9 should be considered as ischemic.¹⁰

Nelzen,⁴ in a population study, found an ABI < 0.9 in 185 (40%) leg ulcers and Scriven,¹¹ in 14% of leg ulcers.

In the present study, in 40 patients diagnosed with chronic venous ulcers (CVU), the concomitant presence of peripheral arterial disease (PAD) was detected in 10 (25%) of them by means of ABI; this ratio was lower than that described by Nelzen (40%),⁴ but higher than those reported by Anderson (24.5%),¹² Scriven (14%)¹¹ and Callam (21%).¹³ Thus, it could be stated that the detection of concomitant chronic venous ulcers (CVU) and peripheral arterial disease (PAD) was frequent in the population studied.

In this study, several variables were analyzed (sex, age, skin color, number of ulcers, locations, recurrence, duration of ulcers, and risk factors for PAD) in 40 patients with chronic venous ulcers in regard to ABI. The purpose was to check the existence of any clinical evidence of the association between PAD and CVU.

The variables sex, age, skin color, number of ulcers, location, recurrence, duration of lesions, smoking, diabetes mellitus, and history of angina/myocardial infarction did not show any statistically significant difference among ratios.

As to the analysis of arterial hypertension and alterations in ABI, there was a statistically significant association between patients with chronic venous ulcers ($p=0.05$). In the group affected with arterial hypertension, 40.9% (9/22 patients) presented an index < 1 , whereas in the group with no arterial hypertension only 7.7% (1/13 patients) of patients had an index < 1 , with a statistically significant difference between the ratios.

From the analysis of these multiple variables one can observe that the series was relatively fragmented. Moreover, despite the use of appropriate statistical methods, it is mandatory to consider the possibility that a larger number of cases studied could lead to statistically significant correlations between the clinical features of CVU and the presence of PAD as indicators of a possible association between CVU and PAD.

CONCLUSIONS

The analysis of the results in this study allowed us to reach the following conclusions:

1 – the presence of PAD detected by the measurement of ABI in patients with CVU was significant and it occurred in 25% of patients;

2 – there was no statistically significant difference between the following variables as compared to the ABI measured in 35 patients with chronic venous ulcer: sex, age, skin color, location, size and number of ulcers, number of recurrences and duration of ulcers, history of angina/acute myocardial infarction, smoking and diabetes mellitus; the analysis of these factors does not enable us to infer the presence of PAD in patients with CVU;

3 – there was a statistically significant association when ABI was analyzed ($p= 0.05$), in which 40.9% of patients with AH presented an ABI < 1 and, in the group of patients without AH, only 7.7% presented altered in ABI;

4 – the positive correlation seen between AH and ABI supports measuring ABI and assessing PAD in patients with chronic venous ulcers associated with arterial hypertension, thus avoiding the compressive treatment. \square

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