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Location of Ulcers on the Lower Limbs in Relation to Distal Systolic Blood Pressure Indices

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The distal systolic blood pressure indices (AI = ankle/arm and TI = toe/arm) of 100 patients with lower limb ulcers at a dermatology outpatient clinic were correlated to ulcer site. The left limb was more often ulcerated than the right. Most ulcers were situated medially, while ulcers on the anterior and posterior sides were infrequent.

An AI below 0.9 and TI below 0.6 is usually considered to indicate arterial insufficiency. Forty-four per cent of the patients had an AI < 0.9 and 66% a TI < 0.6. The lowest mean indices in all ulcerated limbs were found in patients with ulcers on the feet, followed by those with ulcers in lateral and posterior positions. A significantly lower TI ($p = 0.002$) was found in the ulcerated limbs when comparing the patients with one ulcerated and one non-ulcerated leg, but no such difference was found for AI. Thus, the ulcerated and the seemingly healthy limb usually had about the same AI. In all patients, TI decreased significantly with age ($p = 0.0001$). TI was lower in men, than in women, when the effect of age was eliminated ($p = 0.0509$). ***Key words: Leg ulcer; Strain gauge plethysmography; Ischemic arterial disease.***

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Most leg ulcers are caused by vasculatory insufficiency but the list of possible causes is long (1). Venous ulcers are said to be situated mostly on the inner aspect of the lower leg (2), diabetic (3) and arteriosclerotic ulcers often on the feet. Anterior or anterolateral locations have also been implicated for the arteriosclerotic ulcers (4). The site of the ulcer is often used as an indication of the cause of the ulcer but the association to arterial insufficiency has not been thoroughly investigated.

The aim of this study has been to characterize the ulcer sites in 100 dermatological outpatients with ulcers on the lower limbs and to correlate the sites of ulcers to the systolic pressure indices.

MATERIAL AND METHODS

One hundred and thirty-nine ulcer patients consecutively referred to the outpatient dermatology clinic for treatment were considered for the study. Thirty-nine patients with ulcers caused by trauma, tumours, infection and those who refused investigation of systolic pressures were excluded.

The 100 included patients (73 women) had a mean age of 74 +/- 10 years (37–94). Twelve patients (9 women) had diabetes.

The systolic brachial, ankle and toe pressures were measured according to the strain gauge method (5). The normal AI is 1.1 +/- 0.1 (6, 7, 8). A value below 0.9 is usually considered to indicate arterial insufficiency (9). A normal value for TI in the age-group 40–79 years is >0.6 (10).

The ankle pressures were not measured in 18 patients. The age of the patients and the ulcer sites were noted at the time of the pressure investigations.

The sites of the ulcers were classified as medial (inner side), lateral (outside), anterior (front), posterior (back), feet or multiple ulcers. "Multiple" ulcers were situated in more than one location on one limb or in different sites on each leg in the patients with bilateral ulcers.

The study was approved by the Ethics Commitee at Sahlgrenska Hospital.

Statistical methods

The differences between ulcerated and non-ulcerated limbs, within patients, were analysed by means of Student's t-tests and the possible dependence on location for those differences investigated by analysis of variance.

The comparisons between patients were mainly made by analysis of co-variance including the factors location, sex and age. In order to see which sites, if any, differed, the analysis for this factor was supplemented with a multiple comparison test (Newman-Keuls). Patients with two ulcerated limbs were represented by the mean value and patients with one ulcerated leg by the values for that leg.

For descriptive reasons, means and standard deviations (SD) were calculated for different groups and subgroups.

RESULTS

One hundred patients, with 199 legs (1 amputated), had 123 ulcerated limbs. Forty-six patients had ulcers only on the left limb, 31 only on the right limb and 23 patients had bilateral ulcers.

The most common site was medial. Few ulcers

Table I. *Ulcer sites in all limbs and right versus left limbs*

	Right limbs	Left limbs	All limbs	% of all	% of all 123 ulcerated limbs
Healthy	46	30	76	38%	–
Medial	20	24	44	22%	36%
Multiple	15	15	30	15%	24%
Lateral	9	14	23	12%	19%
Foot	4	9	13	7%	11%
Posterior	5	2	7	4%	6%
Anterior	1	5	6	3%	5%
Total	100	99	199		

were found on the posterior and anterior aspects. The distribution of the ulcer sites on left and right limbs is shown in Table I.

AI and TI in ulcerated and non-ulcerated limbs together showed that the mean TI was lower than the mean AI, but there was no difference between the right and left mean indices. The mean AI for all right limbs was 0.91 (SD+/-0.29) and for all left limbs 0.88 (SD+/-0.32). The mean TI for the right limbs was 0.52 (SD+/-0.24) and for the left limbs 0.50 (SD+/-0.25).

Ulcer sites, AI and TI in patients with one ulcerated limb and one limb without ulceration

Seventy-six patients had one ulcerated limb and one without ulcers. The ulcerated limbs had the following distribution of the ulcer sites: medial 33%, lateral 21%, multiple 20%, foot 13%, anterior 8%, and posterior 5%. The limbs without ulcers usually had the same AI as the ulcerated (63 patients); the difference was n.s. ($p = 0.68$). The mean TI (76 patients) was significantly lower on the ulcerated side ($p = 0.002$).

AI and TI in all ulcerated limbs in relation to ulcer site and the influence of age and sex on AI and TI

Forty-four per cent of the patients had an AI <0.9 and 66% a TI <0.6.

The mean AI and TI in the different sites are shown in Table II. The lowest values were seen in the feet, followed by the lateral and then by the posterior positions.

There was no significant difference in mean AI or TI between men and women. The AI was 0.91 (SD+/-0.38) in men and 0.89 (SD+/-0.29) in women, TI 0.42 (SD+/-0.26) in men and 0.51 (SD+/-0.26) in women.

No correlation was found between AI and age ($p = 0.10$) and AI did not differ between males and females ($p = 0.66$). When the influence of age and sex was eliminated, AI was not different between groups of patients with separate ulcer sites ($p = 0.14$).

The TI in all patients showed lower values with increasing age ($p = 0.0001$). When the effect of age was accounted for the TI was found to be lower in men ($p = 0.0509$) than in women.

Table II. *Mean AI and TI in relation to ulcer site*

Site	Number of patients	Mean Ankle/arm Index	SD +/-	Number of patients	Mean Toe/arm Index	SD +/-
Anterior	6	0.99	(0.39)	6	0.46	(0.24)
Medial	22	0.97	(0.30)	25	0.54	(0.26)
Multiple	30	0.92	(0.26)	38	0.57	(0.24)
Posterior	4	0.90	(0.24)	4	0.43	(0.17)
Lateral	11	0.86	(0.40)	17	0.33	(0.22)
Foot	9	0.63	(0.39)	10	0.29	(0.27)
All	82	0.90	(0.32)	100	0.48	(0.26)

AI and TI in feet versus other sites

AI and TI were lower for patients with foot ulcers compared to other sites when the latter were combined into one group. When the possible effects of age and sex were taken into account there were significant differences for both AI ($p = 0.0059$) and TI ($p = 0.0172$).

Ulcer sites in the diabetics. AI and TI in diabetics versus non-diabetics

The 12 diabetes patients had ulcers in the following places: 2 on the feet, 2 medially, 3 laterally, 1 anteriorly and 4 in multiple sites.

The diabetic patients had a higher mean AI (1.01, SD+/-0.34) and a lower mean TI (0.41, SD+/-0.24) compared to the non-diabetic patients (AI 0.88, SD+/-0.32, $p = 0.27$ and TI 0.49, SD+/-0.26, $p = 0.28$) but the differences were not statistically significant. There were still no significant differences in AI ($p = 0.14$) or TI ($p = 0.42$) between the diabetics and the non-diabetics when the possible effects of age and sex were taken into account.

DISCUSSION

Such factors as trauma, oedema (caused by cardiac or renal insufficiency), lymphoedema, diabetes and arthritis can be of importance in the initiation or in the sustained impaired healing of leg and foot ulcers (11). In each individual, these factors should be dealt with in the best possible way. The interacting factors are not always revealed or are impossible to correct completely. When feasible, data should therefore be analysed within each individual and not just as ulcerated limbs. In all statistical calculations, we have therefore used a mean index value for the two limbs in each individual with bilateral ulcerations.

To study the differences between ulcerated and non-ulcerated limbs, patients with unilateral ulcers are preferred to comparing all ulcerated limbs with all limbs without ulcers. In this study, the AI in the ulcerated limbs did not differ from the AI in the seemingly healthy limbs, but the TI was lower in the ulcerated limbs ($p = 0.002$).

The foot ulcers in this study correlated well with arterial insufficiency, with low AI and TI compared to the other locations. The ulcers in the diabetics, however, were not found more often on the feet. In this study, a lower prevalence of foot ulcers was found than in an earlier study (12). The earlier study included patients from all medical specialities, both ambulatory and inpatients. The explanation for the smaller number of foot ulcers (if foot ulcers are considered to be arterial) can be that the ulcers in a dermatological outpatient clinic have other causes, probably mostly venous. More ulcers were found on the left than on the right side, which also is in accordance with venous disease. The prevalences of ilio-femoral thrombosis, varices, chronic venous insufficiency and venous ulcers are higher on the left side, probably related to decreased venous outflow secondary to compression of the left iliac vein by the right iliac artery (13, 14).

Peripheral arterial circulation decreases with age (15, 9). The TI decreased with age in our study ($p = 0.0001$) but not the AI. To be able to see if there is an association or not between ulcer site and AI/TI, it is important to eliminate the influence of age and sex.

The ulcers on the lateral side may also be associated with arterial insufficiency; they had the next lowest AI and TI, followed by the ulcers on the back of the leg, but these associations were not statistically significant. The lateral, posterior and anterior ulcer locations were infrequent and the few observations limit the statistical calculations.

The patients in our study showed a variation from completely normal to very low AI and TI values. The very high and very low pressures give an indication of the prognosis. The risk of slower ulcer healing and of amputation increases with low values (16).

Although, according to the data in this study, there was only a statistically significant relationship with the systolic pressures for ulcers on the feet, patients with all other ulcer locations sometimes had low systolic pressures. Arterial and venous insufficiency often coexist in leg ulcer patients (17). All patients with ulcers on the lower limb should therefore be subjected to evaluation of the peripheral circulation. To establish the possible existence of arterial insufficiency is essential for proper treatment and prognosis (16, 18).

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