



Changes in the Aetiological Spectrum of Leg Ulcers after a Broad-scale Intervention in a Defined Geographical Population in Sweden CME

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WHAT THIS PAPER ADDS?

- The problem of lower limb ulceration is expected to increase in the Western world due to ageing populations. The present study is unique in its kind and has for the first time shown that prevalence can actually be decreased within a defined geographical population. The detectable prevalence decrease of leg ulcers is most likely caused by targeted intervention based on aetiology that was introduced following the baseline epidemiological studies in 1988–1992. It shows that arterial ulcers and venous ulcers, in particular, are most likely to be reduced following early vascular surgery. Some aetiologies, such as multifactorial ulcers that actually increased, are difficult to treat and thus not affected by interventions. The results validate early surgical intervention for ulcers of arterial and venous origin and how that it makes a difference on a population basis.

ARTICLE INFO

Article history:

Received 19 December 2011

Accepted 29 July 2012

Available online 25 August 2012

Keywords:

Leg ulcers

Epidemiology

Aetiology

Arterial ulcers

Venous ulcers

Diabetic ulcers

ABSTRACT

Objective: The study aims to compare the spectrum of leg ulcer aetiology in Skaraborg County in 1988 and 2002, an evaluation of 14 years of targeted leg ulcer intervention.

Design: Cross-sectional study within the professional health-care system in Skaraborg County.

Materials: In 2002, 621 leg ulcer patients were identified through a cross-sectional population survey.

Methods: Half of the registered patients were randomly selected and offered clinical examination. A total of 198 patients with 246 legs underwent examination and were categorised in detail according to aetiology. Data were compared with the initial study in 1988.

Results: Venous incompetence was present in 140 (57%) legs and the dominating cause in 94 (38%) of the leg ulcers, 40 (16%) due to deep venous incompetence. Arterial insufficiency was identified in 90 (37%) legs and the dominating aetiological factor in 41 legs (17%), eight (3%) being critical ischaemic ulcers. The relative risk (RR) of developing a leg ulcer in 2002 vs. 1988 was 0.77. The RR of a venous ulcer was reduced by 46%, arterial by 28%, while there was an increase in diabetic ulcers by 29% and multifactorial by 42%.

Conclusion: The aetiological spectrum of leg ulcers has changed, most likely due to a new management strategy in the care of leg ulcer patients.

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Leg ulcer patients have a significantly poorer quality of life than healthy people^{1,2} and require substantial medical health-care resources rendering in high costs for society.^{3–6} Establishing the aetiology of leg ulcers is the key to successful treatment of leg

ulcers, fundamental to reduce patient suffering and incurred costs. In Skaraborg County, epidemiological studies were conducted between 1988 and 1992,^{7–9} resulting in a new strategy for improving the outcomes for leg ulcer patients. This model has recently been described in detail¹⁰ and the main issues were introducing multidisciplinary teamwork and networking between the community and hospital-based specialists and resources. The primary goal was establishing early ulcer diagnosis and, to enable this, several educational programmes were started as well as the production of guidelines. An important diagnostic tool was the

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early use of hand-held Doppler (HHD) in the community. A proper preliminary diagnosis led to the right level of care following the organised care pathways that were created. The use of early venous surgical and arterial intervention was another important measure taken, enabled by the introduction of using colour duplex ultrasonography (CDU), clearly defining the venous incompetence. The final step was the opening of the Skaraborg Leg Ulcer Center, an inpatient ward with 14 beds shared by vascular surgery, dermatology and the department of infectious diseases. A follow-up study in 2002¹¹ has determined a 23% decreased prevalence of leg ulcers in this geographical area over a 14-year period after this thorough reformation in the care of leg ulcer patients. Further investigation of the results from 2002 in comparison to 1988 shows a dramatic alteration in the distribution of the leg ulcer aetiology. The aim of this study is to present the detailed aetiological spectrum of leg ulcers and to compare this with the previous epidemiological data from the same geographical area.

Method

In the first phase of the study, all leg ulcer patients known to the health-care system in Skaraborg were registered through a postal questionnaire study (a 6-week period from October to December 2002). In the 15 communities of Skaraborg County, with a total population of 254 111 inhabitants, 621 leg ulcer patients were identified. This population was somewhat older than the mean Swedish population, 19.2% above retirement age (>64 years) compared to 17.2%. The only inclusion criterion was an open wound below the knee (including foot ulcers) that did not heal within a 6-week period after onset of ulceration. The method is described in detail in the previously published article¹¹ presenting changes in leg ulcer prevalence numbers.

The study was approved by the local research ethics committee of Gothenburg University, Sweden. As a request by the ethics committee, all patients were offered anonymous registration. Seventy patients (11%) did not consent to registration, apart from disclosing gender and age, resulting in 551 patients being eligible for further investigation. In the second phase, following a geographical stratification and random selection, half of the patients in each community were offered a clinical examination (Fig. 1).

Examination

Altogether, 203 selected patients were examined (in the period 3–9 months following the initial registration) by one observer (author AF) with the aid of an auxiliary nurse and a research assistant. Each patient was interviewed concerning medical history and previous leg ulcer history. A medical examination and non-invasive assessment of the arterial and venous circulation in both legs were performed. Both arterial pressure (calculation of arterial brachial index (ABI)) and venous circulation were primarily assessed by using a HHD by the same method as in the study of 1988.⁹ All legs were graded according to the Venous Clinical Severity Score (VCSS).¹² All patients with clinical signs of venous incompetence (VI), and/or reflux in the groin or in the popliteal fossa with HHD, were offered further investigation with CDU. This technique was performed in our validated hospital laboratory by a vascular technologist according to our general venous protocol, the method described in a local study of venous leg ulcers.¹³ Basically, patients were examined in a standing position or semi-sitting position using a mechanical inflatable cuff to assess venous blood flow and reflux. CDU was not available in the previous study in 1988.⁹ Ninety legs with suspected VI were investigated with CDU (Fig. 2).

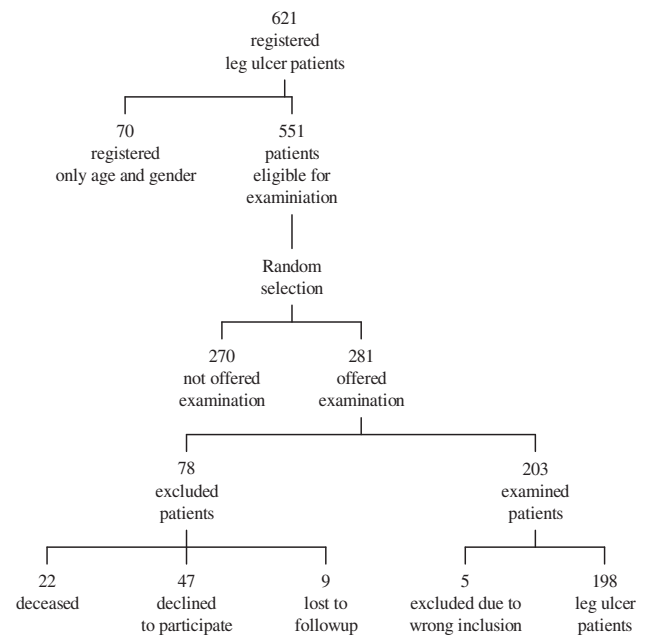


Figure 1. Flowchart of the study.

Definitions

Deep venous insufficiency (DVI) was defined as the presence of incompetent valves in the popliteal vein with/without additional femoral valve incompetence. VI was defined as reflux duration exceeding 0.5 s. Superficial venous incompetence (SVI) was considered present when there was reflux in the great and/or small saphenous veins or both, either at their origins or distal parts, and/or in perforating veins. Post-thrombotic syndrome (PTS) was, in our study, considered present if the patient had a history of DVT (in either leg), and CDU showed popliteal incompetence or if CDU showed signs of thrombosis or occluded veins regardless of earlier history of DVT. Arterial insufficiency was defined as ABI ≤ 0.9 and critical ischaemia ≤ 0.5 .

Renal disease was not documented originally but retrospectively assessed by identifying the examined patients that had attended the Nephrology Department at Skaraborg Hospital in 2002–2003. Diabetes data from the Skaraborg Diabetes Registry¹⁴ (unpublished data from Skaraborg Diabetes registry 2002, B. Berger, MD, PhD) was used in calculating the prevalence of leg ulcers among the diabetic population. Diabetes was defined as the presence of insulin treatment or the treatment of oral hypoglycaemic drugs or diet-controlled diabetes. In 1991, 6500 patients were registered with diabetes mellitus in Skaraborg¹⁵ (prevalence of 2.4%), which increased by nearly 50% until 2002, a number of 9642 patients (prevalence of 3.8%).

Aetiological assessment

At the end of every patient examination, the observer (AF) weighed different aetiological factors based on patient history and the result of clinical and non-invasive examinations to ascertain the most probable cause of the ulcer. Results were cross-checked with the previous observer (ON) to ensure that evaluations were made in a similar manner as in 1988. The ulcers were classified using the same aetiological classification as in the study of 1988.⁹

To enable comparison of the data from the study in 1988⁹ with the study in 2002, the results from the examined group of patients need to be extrapolated to the number of registered patients. Both

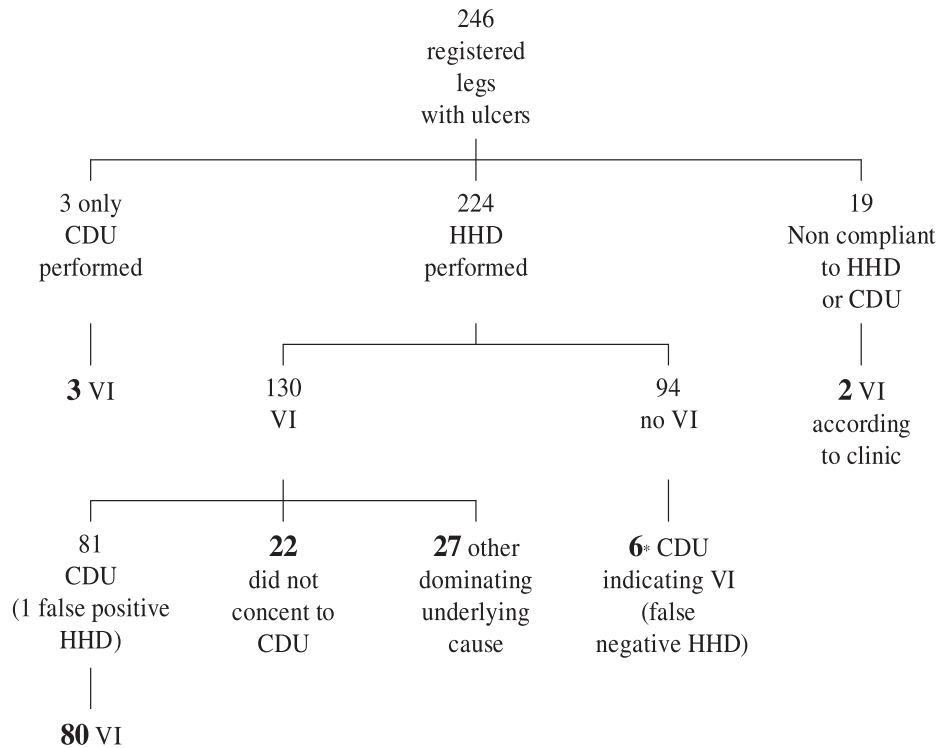


Figure 2. Flowchart of the examinations with hand held Doppler (HHD) and colour duplex ultrasonography (CDU) and the outcome of venous incompetence (VI), the sum of bold numbers (140) illustrating the total number of legs with venous incompetence. *4 legs underwent varicose surgery before HHD.

studies included all known leg ulcers within the health care in Skaraborg County, making the numbers comparable and usable in calculating prevalence numbers. The assumption was made that the distribution of leg ulcer aetiology was the same in the examined and unexamined group of leg ulcer patients. Adjustments of the number of leg ulcer patients registered in 1988^{7,9} (827) were made due to change of county borders (24 patients from the communities Habo and Mullsjö who no longer belong to Skaraborg) as well as excluding 1% of wrongly included patients. This resulted in 795 patients registered in 1988 eligible for comparisons with the patients from 2002. The numbers of 2002 were also adjusted excluding 2% wrong inclusion resulting in 609 patients.

Statistics

All data from the examinations were recorded and processed in Statistical Package for the Social Sciences (SPSS) version 18 (SPSS Chicago, IL, USA). The chi-squared test was used in comparing possible risk factors with respect to proportions of leg ulcers and distribution of different diagnosis. Official statistics was used to acquire data about the population size, age and sex distribution at the time of the study (Statistiska Centralbyrån). The statistical testing of prevalence changes between 1988 and 2002 was calculated by relative risk (RR) with 95% confidence intervals. $P < 0.05$ was considered statistically significant.

Results

Out of 281 invited patients, 203 turned up and were examined, five (2%) were incorrectly included, resulting in 198 patients with 246 ulcerated legs.

The reasons for dropout are shown in Fig. 1. The dropouts were mostly women of older age. Most patients, 160 (79%), were older

than 64 years, and only 10 patients (5%) were younger than 50 years. The age and sex distribution in the examined group was similar to that in the total cohort (Table 1).

Data were processed and presented as objective findings, and based on these a subjective assessment was made in classifying the leg ulcers in the different aetiological groups, according to the predefined classification.⁹

Medical history

Ninety-one patients (46%) were fully mobile, 90 (46%) patients needed some kind of support and 17 patients (9%) were confined to a wheelchair. Sixty percent of all leg ulcers were classified as recurrent ulcers. In Table 2, the medical history of associated diseases and smoking habits are presented.

Diabetes

In 2002, 34% (68/198) of the examined leg ulcer patients reported suffering from diabetes while the proportion in 1988 was 27% (104/382).¹⁵ The leg ulcer prevalence in the whole diabetic population in Skaraborg was calculated by assuming that the

Table 1

Age and sex distribution among the original survey (621 patients), phase 1, and the randomised and examined patients (198), phase 2.

	Phase 1	Phase 2
Men	254 (41%)	82 (41%)
Women	367 (59%)	116 (59%)
Median age	79	76
Men	75	72
Women	81	79
Age range	16–99	30–98

Table 2
Medical history and smoking habits in 198 patients with lower limb ulceration.

	Number of patients
Diabetes	68 (34)
Diet only	13 (7)
Oral antidiabetic drugs	11 (6)
Insulin	44 (22)
Hypertension	95 (48)
Cardiac disease (angina pectoris, myocardial infarction)	88 (44)
Rheumatic disease	15 (8)
Arthrosis	43 (20)
Renal disease ^a	22 (9)
Stroke	25 (13)
Smoking	9 (5)
Stopped smoking	53 (27)
History of DVT (either leg)	37 (19)

Values in parentheses are percentages.

^a Retrospective assessment (see Method).

frequency of diabetes mellitus among the examined and non-examined patients was equal, resulting in 209/609 in 2002 and 225/827 in 1988. In 2002, 209/9624 (2.2%) of all diabetes patients had lower leg or foot ulceration (all types) and, in 1988, this number was 225/6500 (3.5%).¹⁵

Arterial circulation

Pathological ABI (0.9 or less) was found in 90 (37%) of the 246 investigated legs, compared to 40% (185/463) in 1988,⁹ and was more common in the group with active leg ulcers, 44% (62/141), than in the group with healed ulcers, 25% (26/105). An ABI of 0.5 or less and non-compressible arteries were more common among the foot ulcers than ulcers located above the foot (Table 3). The legs with foot ulcers having normal ABI (24) were mainly diabetic ulcers (10) and pressure ulcers (4). The 10 remaining ulcers were equally distributed throughout the other groups. One ulcerated leg with secondary normal ABI had prior to investigation undergone arterial reconstruction. The mean ankle pressure in ulcerated legs with pathologic ABI was 114 ± 30 mmHg (median 117, range 60–170) compared with 175 ± 28 mmHg (median 174, range 120–265) in legs with normal ABI. Similar levels of mean ankle pressures were noted in 1988.⁹

Venous incompetence

The outcome of HHD and CDU investigation is shown in Table 4. After clinical examination, HHD and CDU, VI was found in 140 (57%) ulcerated legs (Fig. 2). These 140 legs had a median VCSS score of 10 (range 1–22), compared to a median of 7 (range of 1–16) among the legs with no VI. VI was clearly diagnosed (especially by CDU) as

Table 3
Distribution of ankle/brachial pressure index (ABI) in 246 examined legs overall and according to ulcer location and presence of ulcer at the time of the examination.

ABI	Number of legs	Ulcer location		Ulcer status at the examination	
		Above foot 172 legs	Isolated foot ulcer 74 legs	Active ulcer 141 legs	Healed ulcer 105 legs
≤0.5	15 (6)	6 (4)	9 (12)	11 (8)	4 (4)
0.6–0.7	30 (12)	24 (14)	6 (8)	24 (17)	6 (6)
0.8–0.9	45 (18)	28 (16)	15 (20)	27 (19)	16 (15)
Non-compressible arteries	37 (15)	17 (10)	20 (27)	18 (13)	19 (18)
Normal ABI	119 (48)	97 (56)	24 (32)	61 (43)	60 (57)

Values in parentheses are percentages.

Table 4
The distribution of SVI and DVI after investigation with HHD and CDU respectively.

	All HD investigated legs	Legs with venous incompetence according to HHD	CDU (90 selected cases with signs of venous incompetence)
SVI	78/224 (35)	78/130 (60)	51/90 (56)
DVI	52/224 (23)	52/130 (40)	38/90 (42)

SVI = Superficial venous incompetence, DVI = Deep venous incompetence, HHD = bi-directional hand held Doppler, CDU = colour duplex ultrasonography. Values in parentheses are percentages.

isolated SVI or DVI (Table 4), SVI being more common. In 1988, VI was identified in 332 (72%) ulcerated legs, including 156 (47%) SVI and 176 (53%) DVI.⁹ In 2002, SVI was found more common among women, 50/142 (35%), than men, 28/104 (26%), while DVI was present in 25% for both women (36/142) and men (26/104). All legs with combined DVI and SVI were classified as DVI. HHD identified 30/52 (58%) legs with combined incompetence, while CDU revealed 29/38 (76%) legs. PTS was diagnosed in 24 of the 90 patients (27%) investigated by CDU and four of these had no previous history of DVT.

Combined venous and arterial incompetence was identified in 22% (55/246) of the investigated legs. In 2002, 43 (17%) of the investigated legs had no arterial or venous disturbance compared to 45 (10%) of the legs in 1988.

Aetiologic classification

The summarised outcome of the aetiological classification according to earlier defined classification⁹ is shown in Table 5. In the study, 70% of all examined legs ulcers were located above the foot. Ulcers with domination venous aetiology were mainly located above the foot, 96% (90/94), while diabetic and arterial ulcers were most often located on the foot, 70% (48/97). Diabetic ulcers were in 90% isolated foot ulcers.

Venous insufficiency was considered the dominating cause in 94 (38%) of the leg ulcers, of which 40 (43%) were due to DVI. The legs with venous ulcers had a median VCSS score of 10 (range 4–19).

Table 5
Causes of leg ulcers in all 246 ulcerated legs, in 172 legs with ulcers above the foot and 74 legs with isolated foot ulcers.

Aetiologic group	All ulcers	Ulcers above the foot	Isolated foot ulcers
1. Venous ^a	78 (32)	74 (43)	4 (5)
a) Superficial	45 (18)	43 (25)	2 (3)
b) Deep	33 (13)	31 (18)	2 (3)
2. Mixed venous and arterial ^{a,b}	16 (7)	16 (7)	0
a) Superficial	9 (4)	9 (5)	0
b) Deep	7 (3)	7 (4)	0
3. Mixed arterial and venous ^{a,b}	14 (6)	13 (8)	1 (1)
a) Superficial	10 (4)	10 (6)	0
b) Deep	4 (2)	3 (2)	1 (1)
4. Arterial	9 (4)	4 (2)	5 (7)
a) Critically ischaemic	2 (1)	0	2 (3)
b) Possible arterial influence	7 (3)	4 (2)	3 (4)
5. Arterial and diabetes	27 (11)	3 (2)	24 (32)
a) Critically ischaemic	6 (2)	0	6 (8)
b) Possible arterial influence	21 (9)	3 (2)	18 (24)
6. Diabetic	20 (8)	2 (1)	18 (24)
7. Traumatic	3 (1)	2 (1)	1 (1)
8. Pressure	10 (4)	3 (2)	7 (10)
9. Multifactorial A + V + D ^c	3 (1)	2 (1)	1 (1)
10. Other multifactorial	44 (18)	34 (20)	10 (14)
11. Other single causes	22 (9)	19 (11)	3 (4)

Values in parentheses are percentages.

^a Classification deep and superficial due to investigation by DUPLEX.

^b Underlined marking dominating aetiological factor.

^c A + V + D = Arterial + Venous + Diabetes.

A pragmatic way of calculating all ulcers with arterial incompetence considered as the major cause was including two-thirds of group 5 ('arterial and diabetes' Table 5) and including the other one-third among the diabetic leg ulcers, in order not to overestimate the influence of arterial incompetence. Arterial incompetence was the dominating aetiological factor in 41 (17%) legs, and eight (3%) of these were critically ischaemic ulcers. Diabetic ulcers (neuropathic) represented 29/246 (12%) of the examined ulcerated legs.

Multifactorial leg ulcers comprised 19% (47) of all the investigated leg ulcers (Table 5). There was a tendency of increased frequency of cardiovascular disease and decreased mobility among these patients. Leg ulcer patients at nursing homes, or receiving professional care in their own homes, showed a higher proportion of multifactorial ulcers (29% vs. 14%, $P = 0.004$). Women tended to be overrepresented in the multifactorial leg ulcer group, representing 70% of the patients compared to 55% in the other aetiological groups ($P = 0.054$). In the multifactorial group, 43% had signs of VI, 23% SVI and 19% DVI. An ABI ≤ 0.9 was present in 23/42 legs and 5/42 had non-compressible arteries. Eleven percent had a verified renal disease.

Fourteen percent (35) of the leg ulcers were caused by other factors (traumatic, pressure and other single causes). The other single causes of leg ulcers were three vasculitis, seven hydrostatic, two tumour and 10 other (lymph oedema, rheumatism, cutaneous lupus erythematosus, artefact, atrophic skin, haematological disease and adiposity).

Aetiological groups in 2002 compared to groups in 1988

The RR of an active leg ulcer was significantly lower in 2002 (RR 0.77) than in 1988 (Table 6). The estimated percentage of leg ulcers with dominating venous aetiology in Skaraborg show a total reduction over time from 54% (250/463)⁹ to 38% (94/246) (Table 5). The RR of having a venous ulcer was reduced by 46% (Table 6). The RR of an arterial ulcer was reduced by about 28% (Table 6). The prevalence of diabetic ulcers was significantly increased by 29%. In 2002, 12% (72/609) of all leg ulcers were diabetic ulcers compared with 7% (56/795) in 1988. However, in the total diabetes population in Skaraborg, the prevalence of diabetic ulcers was actually lower, 0.7% (72 diabetic ulcers/9642 diabetic patients), in 2002 compared to 0.9% (56 diabetic ulcers/6500 diabetic patients) in 1988. The RR of developing a multifactorial ulcer was increased by 42% (Table 6).

Discussion

This study is unique in its character in presenting changes in epidemiological data of leg ulcer prevalence and aetiology within

Table 6
Comparison of prevalence and relative risk (RR) of the main aetiological leg ulcer groups in 1988 and 2002.

	Year 1988		Year 2002		RR (2002 vs. 1988)	95% CI ^c for RR
	N ^a	Prevalence ^b	N ^a	Prevalence ^b		
Venous	429	168	233	92	0.54 ^d	0.46–0.64
Arterial	142	56	102	40	0.72 ^d	0.56–0.93
Diabetes	56	22	72	28	1.29	0.91–1.83
Other	86	34	86	34	1.00	0.74–1.35
Multifactorial	82	32	116	46	1.42 ^d	1.07–1.88
Total	795	312	609	239	0.77 ^d	0.69–0.85

^a Estimated number of leg ulcers diagnosis in the total number of registered leg ulcer patients.

^b Period prevalence (period = 6 weeks). Standardised per 100 000 inhabitants.

^c CI = confidence interval.

^d Statistically significant difference (at 5%-level) between prevalence for 1988 and 2002.

a defined population before and after the initiation of a broad-scale intervention. To our knowledge, no other studies of this character have previously been performed. Large epidemiological studies such as the Bonn Vein Study¹⁶ clearly describe the prevalence of chronic venous disease but provide no reliable estimates regarding venous ulcers. In that study, only three active leg ulcers were identified among 3072 participants and the material was a limited cohort of 18–79 years of age.

One strength of this study is the use of the same method as in 1988,⁹ making the results from the two studies comparable. Although the first author mainly performed the study of 2002, the author (ON) and the research assistant (IF) from the previous studies^{7–9} were also involved. Another strength is the lack of selection bias since all leg ulcers located below the knee, including foot ulcers, were registered regardless of cause. The obtained data give a clear picture of the entire workload for health care in caring for the leg ulcer patients. Although this study illustrates the change in prevalence and aetiological spectrum of leg ulcers in our geographical area, it does not necessarily reflect the situation in other places.

A weakness of the study is the smaller proportion of registered leg ulcer patients that were eligible for further investigation in 2002 (198/609 (33%)) compared with 1988 (382/827 (46%)).⁹ The tougher requirements from the ethics committee probably limited the number of patients that accepted to be fully registered. However, a sufficiently large group of patients were investigated to be representative of the whole material (Table 1). The age distribution among the examined and unexamined patients was the same. There was a slight overrepresentation of women who did not want to be examined.

The study in 1988⁹ was followed by a population study in 1990⁸ based on a validated questionnaire including 12 000 randomly selected inhabitants of Skaraborg County and the city of Malmö, aged 50–89 years. The results indicated that there was a high rate of self-treatment among leg ulcer patients as the observed point prevalence of active leg ulcers was 0.63%, more than double than expected. To ascertain that the observations of decreased leg ulcer prevalence in the study of 2002¹¹ are reliable, a population study using the same questionnaire as in 1990 was performed in 2005 including 10 000 randomly selected Skaraborg County inhabitants aged 30–89 years. Preliminary data support the results of decreased leg ulcer prevalence in 2002¹¹ as the observed prevalence was lower in all comparable age groups (1990 vs. 2005).

Despite the fact that 9 years have passed since the last patients were examined, the results are still valid as the primary aim was assessing how the radical change of management strategy had affected the aetiological spectrum of leg ulcers. The results show that venous and arterial ulcers have been substantially reduced, most likely due to early diagnosis and targeted interventions. The interventions today differ little from 2002 and the total number of arterial interventions per year is basically unchanged, making it unlikely to bias the results. The figures today probably have improved even further, but the exact prevalence figures are maybe more of local interest. The most important finding is that ulcers of venous and probably also arterial aetiology can be reduced by organised care of these patients.

Proof for a more active intervention of arterial ulcers in Skaraborg was shown already in the follow-up study in 1989–1993¹⁷ as the arterial ulcers that had not healed within a year underwent arterial intervention regardless of ABI or absolute pressure. That study also showed the need for venous intervention as conventional conservative therapy failed. Another long-term study in Skaraborg illustrated low recurrence rate in venous ulcers after SEPS combined with superficial venous surgery.¹³

The results show that venous disease is no longer as dominating as before, although it is still the single-most common factor causing leg ulcers. Both the ulcerated legs with SVI and DVI showed a decrease in number, DVI showing the most marked reduction from 38% in 1988 to 25% in 2002. One plausible explanation is a reduced number of post-thrombotic legs although our study design could not prove this. CDU enabled us to distinguish between DVI due to PTS, primary DVI and DVI secondary to extensive SVI. There is a great risk in overestimating PTS just based on history and clinical signs, since there are no discriminating signs to differ a PTS leg from legs with VI of other causes. Still, many patients with PTS are eligible for palliative intervention for associated SVI and perforator incompetence.¹³ The use of more radical and early venous surgery for superficial and perforator incompetence maybe the most important intervention in decreasing venous leg ulcer prevalence. Compression therapy has probably also an important role in affecting these numbers; however, surgery is scientifically the method of choice in reducing recurring ulcers.^{13,18} In Skaraborg, the focus on educating in prescribing the right kind of compression has led to a substantial increase in the prescription and use of graduated compression hosiery. The usage of all compression for venous ulcers has increased since 1988. These factors may also contribute to why DVI no longer is the dominating underlying cause of leg ulcers.

The reduction in arterial leg ulcers is probably the result of an extensive work including more liberal use of arterial interventions, involvement of podiatrists and improved topical treatment. Medical intervention aimed at decreasing cardiovascular morbidity, with statins and platelet inhibitors, is probably also an important factor as is smoking cessation. The ageing population is, however, a factor that is expected to increase the number of patients with leg ulcers,^{19,20} and thus the true impact might in fact have been underestimated in our study.

Our figures from 2002 indicate an increase of diabetic ulcers. The prevalence of neuropathic ulcers among the diabetic mellitus population was actually, however, unchanged due to a growing diabetes mellitus population illustrated by using data from the regional diabetes registry (see [Method](#)).

The aetiological group of patients with legs of multiple causes increased substantially. For these patients, it is important to optimise several parameters including medical health, nutritional status and mobility of the patient through an extended multidisciplinary assessment and care. In the registered parameters within the study, we could not find an increased morbidity among these patients although the need of help for daily activities seemed increased. It would probably have been of value to register more parameters such as data on body mass index (BMI), cancer, dementia and number of drugs or times treated in hospital. The most plausible explanation for the observed increase is an ageing population.

There is room for further improvement in reducing the number of leg ulcer patients, especially venous leg ulcers since the majority is caused by isolated SVI. Our results support that all leg ulcers patients should be investigated with a HHD, evaluating both arterial and venous circulation. In addition, all patients with venous ulcers and judged to be reasonably healthy should be offered CDU and early venous surgery. In Skaraborg, the multidisciplinary work of improving the health-care situation for the leg ulcer patients and the education of health-care workers is continuous. There is reason to believe that the prevalence number of leg ulcer patients can and will be further reduced.

Funding

Study funding was provided by the Research Fund at Skaraborg Hospital.

Conflict of Interest

None.

Acknowledgements

We thank Mrs Ingvor Fransson (IF), research assistant, for data handling and examination of patients and Mrs Rose-Marie Johansson, auxiliary nurse, for help examining patients and Salmir Nasic, at the research and development council (FoU) Skaraborg, for help concerning the statistics.

References

- 1 Persoon A, Heinen MM, van der Vleuten CJ, de Rooij MJ, van de Kerkhof PC, van Achterberg T. Leg ulcers: a review of their impact on daily life. *J Clin Nurs* 2004 Mar;**13**(3):341–54.
- 2 Jull A, Walker N, Hackett M, Jones M, Rodgers A, Birchall N, et al. Leg ulceration and perceived health: a population based case-control study. *Age Ageing* 2004 May;**33**(3):236–41.
- 3 Ruckley CV. Socioeconomic impact of chronic venous insufficiency and leg ulcers. *Angiology* 1997;**48**:67–9.
- 4 Nelzén O. Leg ulcers: economic aspects. *Phlebology* 2000;**15**:110–4.
- 5 Ragnarson-Tennvall G, Hjemlgrén J. Annual costs of treatment for venous leg ulcer in Sweden and the United Kingdom. *Wound Repair Regen* 2005;**13**:13–8.
- 6 Ellison DA, Hayes L, Lane C, Tracey A, McCollum CN. Evaluating the cost and efficacy of leg ulcer care provided in two large UK health authorities. *J Wound Care* 2002 Feb;**11**(2):47–51.
- 7 Nelzén O, Bergqvist D, Hallböök T, Lindhagen A. Chronic leg ulcers: an underestimated problem in health care among elderly patients. *J Epidemiol Community Health* 1991;**45**:184–7.
- 8 Nelzén O, Bergqvist D, Lindhagen A. The prevalence of chronic lower-limb ulceration has been underestimated: results of a validated population questionnaire. *Br J Surg* 1996;**83**:255–8.
- 9 Nelzén O, Bergqvist D, Lindhagen A. Leg ulcer etiology – a cross-sectional population study. *J Vasc Surg* 1991;**14**:557–64.
- 10 Nelzén O. Fifty percent reduction in venous ulcer prevalence is achievable – Swedish experience. *J Vasc Surg* 2010 Nov;**52**(5 Suppl.):39S–44S [Conference proceedings].
- 11 Forssgren A, Fransson I, Nelzén O. Leg ulcer point prevalence can be decreased by broad-scale intervention: a follow-up cross-sectional study of a defined geographical population. *Acta Derm Venereol* 2008;**88**(3):252–6.
- 12 Rutherford RB, Padberg FT Jr, Comerota AJ, Kistner RL, Meissner MH, Moneta GL. Venous severity scoring: an adjunct to venous outcome assessment. *J Vasc Surg* 2000 June;**31**(6):1307–12.
- 13 Nelzén O, Fransson I. True long-term healing and recurrence of venous leg ulcers following SEPS combined with superficial venous surgery: a prospective study. *Eur J Vasc Endovasc Surg* 2007 Nov;**34**(5):605–12.
- 14 Berger B, Stenström G, Chang Y-F, Sundqvist G. The prevalence of diabetes in a Swedish population of 280,411 inhabitants. *Diabetes Care* 1998;**21**(4):546–8.
- 15 Nelzén O, Bergqvist D, Lindhagen A. High prevalence of diabetes in chronic leg ulcer patients: a cross-sectional population study. *Diabetic Med* 1993;**10**:345–50.
- 16 Pannier-Fischer F, Rabe E. Epidemiology of chronic venous diseases. *Hautarzt* 2003 Nov;**54**(11):1037–44.
- 17 Nelzén O, Bergqvist D, Lindhagen A. Long-term prognosis for patients with chronic leg ulcers: a prospective cohort study. *Eur J Vasc Endovasc Surg* 1997 May;**13**:500–8.
- 18 Howard DP, Howard A, Kothari A, Wales L, Guest M, Davies AH. The role of superficial venous surgery in the management of venous ulcers: a systematic review. *Eur J Vasc Endovasc Surg* 2008 Oct;**36**(4):458–65.
- 19 Graham ID, Harrison MB, Nelson EA, Lorimer K, Fisher A. Prevalence of lower-limb ulceration: a systematic review of prevalence studies. *Adv Skin Wound Care* 2003 Nov;**16**(6):305–16 [Review].
- 20 Cornwall JV, Dore CJ, Lewis JD. Leg ulcers: epidemiology and aetiology. *Br J Surg* 1986;**73**(9):693–6.