

# Validation of the new venous severity scoring system in varicose vein surgery

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**Objectives:** We performed this observational study to validate the three components of a new venous severity scoring (VSS) system, ie, venous clinical severity score (VCSS), venous segmental disease score (VS DS), and venous disability score (VDS), and to evaluate VCSS, VDS, and CEAP clinical class and score in quantifying outcome of varicose vein surgery.

**Patients and Methods:** The study included 45 patients who underwent superficial venous surgery in 48 legs with primary varicose veins. Venous color duplex scanning, clinical examination, and a questionnaire were used preoperatively and at 6 weeks and 6 months postoperatively to assign VSS and CEAP clinical class and score.

**Results:** CEAP clinical score, VCSS, and VDS demonstrated a linear association with CEAP clinical class ( $P < .001$ ,  $P < .001$ ,  $P = .002$ , respectively). Good correlation among all severity scores was found, particularly between CEAP clinical score and VCSS ( $r = 0.94$ ;  $P < .001$ ). CEAP clinical score was also highly correlated with CEAP clinical class ( $r = 0.84$ ;  $P < .001$ ) and VDS ( $r = 0.70$ ;  $P < .001$ ). Similarly, VCSS correlated with CEAP clinical class ( $r = 0.83$ ;  $P < .001$ ) and also VDS ( $r = 0.72$ ;  $P < .001$ ). The anatomic severity marker VS DS demonstrated a weak correlation with clinical severity indicators VCSS ( $r = 0.29$ ;  $P = .048$ ) and VDS ( $r = 0.31$ ;  $P = .03$ ) but not with age, gender, or CEAP clinical class and score. Six months after surgery the median (interquartile range) percent change in VCSS (73%; range, 50%-100%) and CEAP clinical score (70%; range, 50%-100%) were both significantly greater ( $P < .001$ ) than the corresponding change in CEAP clinical class (17%; range, 0%-50%). In legs with high VDS at baseline, median (interquartile range) percent change in VDS was 100% (range, 50%-100%), significantly greater ( $P < .001$ ) than the corresponding change in CEAP clinical class (0%; range, 0%-17%).

**Conclusions:** Venous severity scores are significantly higher in advanced venous disease, demonstrating correlation with anatomic extent. Both venous clinical severity scores, VCSS and CEAP clinical score, are equally sensitive and significantly better for measuring changes in response to superficial venous surgery than is the already in use CEAP clinical class. VDS demonstrated comparable and even better performance. Although the assignment of CEAP clinical class might be adequate for daily clinical purposes, venous severity scoring systems should be used in clinical studies to quantify venous outcome. (J Vasc Surg 2003;38:224-8.)

Varicose vein prevalence and the number of operations performed worldwide for that reason classify varicosities as the most common vascular disease. Inasmuch as several related issues are controversial, studies and trials of venous disease are still necessary. Reliable outcome assessment is of paramount importance for those studies, although the methods currently in use are more qualitative than quantitative and therefore probably not sensitive enough to gauge

treatment.<sup>1,2</sup> This could explain the existence of several classification and scoring systems, including specialized quality of life questionnaires; however, the ideal method remains to be established.<sup>1-5</sup>

The established CEAP (Clinical, Etiologic, Anatomic, Pathophysiologic) classification system for chronic venous disease has been successfully used to classify stages of venous disease, enabling patient comparison among different centers and studies.<sup>1</sup> The CEAP clinical class has seven categories, ie, C0 to C6. However, CEAP clinical class is not particularly useful for outcome measurements, because it is only a 7-point score and because some of its components are static (C4, C5) and therefore not sensitive to demonstrate changes after therapeutic measures. For those reasons, an 18-point clinical score and disability score was introduced.<sup>6</sup>

A new venous severity scoring (VSS) system has been recently proposed by the American Venous Forum Ad Hoc Committee on Venous Outcomes Assessment as a useful and reliable method for outcome quantification, comparison of different management approaches, and reports in the management of chronic venous disease (CVD).<sup>7</sup> The proposed system has three elements: venous clinical severity score (VCSS), which is a modification to replace CEAP clinical score; venous segmental disease score (VS DS),

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which is a combination of the anatomic and pathophysiologic components of CEAP; and venous disability score (VDS), a modification of the original CEAP disability score. It is believed that these three components together can be used as an integrated and improved method for assessing venous outcome.<sup>6</sup>

The purpose of the present study was to validate VSS components and to compare VCSS and VDS with clinical class, clinical score, and disability score of the CEAP system in quantifying outcome of varicose vein surgery.

## MATERIAL AND METHODS

Forty-seven consecutive patients with primary symptomatic varicose veins, undergoing superficial vein surgery in 50 legs, participated in the study. All patients gave informed consent. After excluding 2 patients not available for follow-up because they had both moved out of the area, complete follow-up data were available for statistical analysis for 45 patients (48 legs, 96%). Clinical examination and a questionnaire were used preoperatively for each patient to assess the following:

1. CEAP clinical class<sup>1</sup> (Table I, online only)
2. The 18-point CEAP clinical score<sup>6</sup> (Table II, online only)
3. VCSS<sup>7</sup> (Table III, online only)
4. The 3-point CEAP disability score (0 = asymptomatic; 1 = symptomatic, can function without support device; 2 = can work 8-hour day only with support device; 3 = unable to work even with support device) and its modification, VDS (0 = asymptomatic; 1 = symptomatic but able to carry out usual activities [ie, activities performed before onset of disability from venous disease] without compressive therapy; 2 = can carry out usual activities only with compression and/or limb elevation; 3 = unable to carry out usual activities even with compression and/or limb elevation)<sup>7</sup>

The differences between CEAP clinical score and VCSS are shown in Table IV.

Color duplex scanning was performed to assign VSDS for reflux; this is the sum of the scores assigned for each individual venous segment, as follows: short saphenous, 0.5; long saphenous, 1; thigh perforators, 0.5; calf perforators, 1; multiple calf veins, 2 (posterior tibial alone, 1); popliteal vein, 2; superficial femoral vein, 1; profunda femoris vein, 1; common femoral vein and above, 1. Maximum reflux score was 10.<sup>7</sup> Because postthrombotic legs were not included in our study, we did not calculate the proposed VSDS for obstruction.<sup>7</sup>

Thirty-eight legs underwent surgery of the long saphenous system only, involving flush saphenofemoral ligation and stripping of the long saphenous vein to below the knee. Eight legs underwent short saphenous vein surgery only, involving saphenopopliteal junction ligation. In 2 legs both saphenous systems were managed as described. In addition, avulsion phlebectomy was performed in all patients.

**Table IV.** Comparison of CEAP clinical score and VCSS

| CEAP clinical score* | VCSS†               |
|----------------------|---------------------|
| Pain                 | Pain                |
| Edema                | Varicose Veins      |
| Venous claudication  | Venous edema        |
| Pigmentation         | Skin pigmentation   |
| Lipodermatosclerosis | Induration          |
|                      | Inflammation        |
| Ulcer size           | Ulcer size          |
| Ulcer duration       | Ulcer duration      |
| Ulcer number         | Ulcer number        |
| Ulcer recurrence     | Compression therapy |

VCSS, Venous clinical severity score.

\*Maximum score, 18.

†Maximum score, 30.

Patients were followed-up postoperatively at 6 weeks and 6 months to assign VCSS, VDS, and CEAP clinical class and score.

The Kolmogorov-Smirnov test was used to test data for normal distribution. Nonparametric statistical tests (Wilcoxon signed rank test, Mann-Whitney *U* test, Kruskal-Wallis test, Spearman rank correlation, and Kendall's tau-b test) were used. SPSS for Windows (version 11; SPSS Inc, Chicago, Ill) was used for statistical analysis.  $P < .05$  was considered statistically significant.

## RESULTS

Median patient age was 51 years (range, 19-86 years), and 23 patients were men. Thirty-one legs (65%) were classified in CEAP clinical classes 4 to 6.

**Score intercorrelation.** CEAP clinical score, VCSS, and VDS were all increased linearly in advanced CEAP clinical class ( $r = 0.84$ ,  $r = 0.83$ ,  $r = 0.5$ , respectively; all  $P < .001$ ); similar results were obtained with the Kruskal-Wallis test (Fig 1). For example, median VCSS increased progressively from 3 in CEAP clinical class 2 to 13.5 in CEAP clinical class 6; the other scores demonstrated the same pattern.

No significant relationship was found between gender or age with preoperative CEAP clinical class or score, VCSS, or VDS (all  $P > .05$ , Spearman correlation or Mann-Whitney test). However, a significant correlation among all severity scores was found, particularly between CEAP clinical score and VCSS ( $r = 0.94$ ;  $P < .001$ ). Similarly, CEAP clinical score was correlated with CEAP clinical class ( $r = 0.84$ ;  $P < .001$ ) and VDS ( $r = 0.70$ ;  $P < .001$ ). VCSS was also correlated with CEAP clinical class ( $r = 0.83$ ;  $P < .001$ ) and VDS ( $r = 0.72$ ;  $P < .001$ ). CEAP disability score showed agreement with VDS in all but two cases (Kendall's tau-b 0.95; approximate *T*, 12.1;  $P < .001$ ); thus no further correlations were performed.

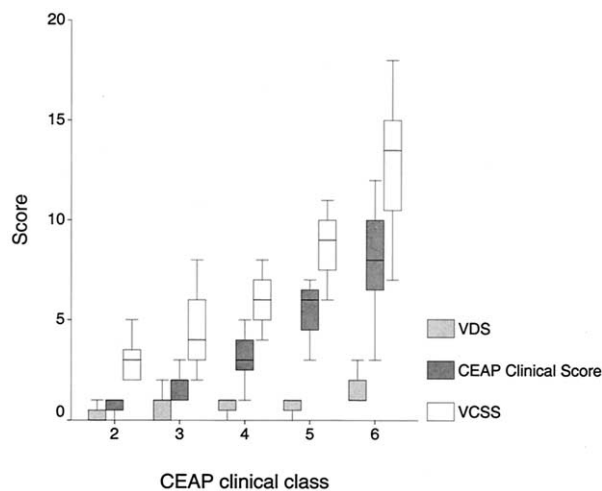
**Association between clinical and anatomic scores.** Median VSDS for reflux was 1 (range, 0-3.5); superficial venous reflux and incompetent perforator veins accounted

**Table V.** Percent change in CEAP clinical class and score, VCSS, and VDS at 6 wk and 6 mo postoperatively

|                     | Follow-up |                     |        |                     |
|---------------------|-----------|---------------------|--------|---------------------|
|                     | 6 wk      |                     | 6 mo   |                     |
|                     | Median    | Interquartile range | Median | Interquartile range |
| CEAP clinical class | 0         | 0-16.7              | 16.67  | 0-100               |
| CEAP clinical score | 66.67     | 22.9-87.1*          | 70     | 50-100*             |
| VCSS                | 66.67     | 50-84.3*            | 73.33  | 50-100*             |
| VDS                 |           |                     |        |                     |
| All patients        | 50        | 0-100*              | 100    | 0-100               |
| VDS >0              | 100       | 0-100*              | 100    | 50-100*             |

VCSS, Venous clinical severity score; VDS, venous disability score.

\*Statistical significance in comparison with CEAP clinical class (all  $P < 0.01$ ).



**Fig 1.** Median CEAP clinical score, venous clinical severity score (VCSS), and venous disability score (VDS) in relation to chronic venous insufficiency severity, as classified with CEAP clinical class ( $P < .001$ ,  $P < .001$ ,  $P = .008$ ; Kruskal-Wallis test).

for all but one case, with coexisting reflux in the deep venous system, confined to the posterior tibial veins. No association was found between VSDS and age ( $r = 0.12$ ;  $P = .44$ ), gender, or CEAP clinical class ( $r = 0.10$ ;  $P = .49$ ) and score ( $r = 0.25$ ;  $P = .09$ ). However, a weak association was found between VSDS and VCSS ( $r = 0.29$ ;  $P = .048$ ; Fig 2) and VDS ( $r = 0.31$ ;  $P = .03$ ).

**Score change after surgery.** CEAP clinical class and score, VCSS, and VDS all significantly changed at 6 weeks and 6 months in comparison with preoperative values (Fig 3). Although median CEAP clinical class did not change (Fig 3), its distribution changed significantly, as a result of the change demonstrated in legs with CEAP class 2 or 3 disease. In contrast, median CEAP clinical class did not change in legs with CEAP class 4 to 6 disease (Fig 4).

The percentage of change between preoperative and postoperative values of the clinical severity scoring systems was used as a measurement of the sensitivity of each assessment tool. These values were related to their respective preoperative VCSS levels. Score changes after surgery were

already evident at week 6 and remained stable after 6 months (Table V). Overall change was about 70% in the case of CEAP clinical score and VCSS, and was only 17% in the case of CEAP clinical class (all  $P \leq .001$ ). The difference between percentage change in CEAP clinical score and VCSS at 6 months was not statistically significant ( $P = .45$ ). Median VDS change (100%) at 6 months was statistically significant only in legs with baseline VDS score more than 0 (Table V). Legs with CEAP class 2 or 3 disease demonstrated significantly greater changes in VCSS at 6 weeks and with all four scoring methods (CEAP clinical score and class, VCSS, and VDS) at 6 months ( $P = .003$ ,  $.001$ ,  $< .001$ ,  $.017$ , respectively), compared with legs with CEAP class 4 to 6 disease (Fig 5). No association was found between VSDS and postoperative score change ( $P > .05$ ).

## DISCUSSION

Assessment of venous outcome has been the subject of several reports and studies<sup>1-6</sup>; however, introduction of new or improved methods, including instruments of quality of life, implies that there is no universally accepted system. As a reflection of this, the American Venous Forum Ad Hoc Committee on Venous Outcomes Assessment recently introduced a venous severity scoring system, stating that "the widespread use of a properly designed disease severity scoring scheme should allow patient groups of similar degrees of severity to be selected for entry into clinical trials and to be compared in regard to outcome following different therapies".<sup>7</sup> The committee's intention was that the new scoring scheme be viewed as complementary to the current CEAP system; this is probably true for CEAP clinical class, which is simple and therefore suitable for everyday clinical purposes.

We found a linear association of both CEAP clinical score and VCSS with CEAP clinical class, a traditional indicator of venous disease severity. Similar median VCSS values and overall association of VCSS with CEAP clinical class have been reported by Meissner et al,<sup>8</sup> supporting the validity of these scores. These authors also reported excellent performance of VCSS in differentiating normal legs from those with venous disease, and legs with severe venous disease from those with moderate venous disease or normal legs (area under curve with receiver operating characteris-





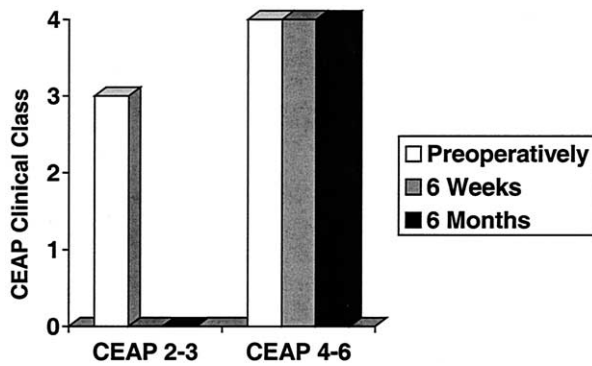


Fig 4. Median CEAP clinical class before and after surgery in patients stratified by CEAP clinical class.

research and larger series are needed to decide which factors can be removed from the VCSS to make it easier and simpler without losing sensitivity. Although assessment of reproducibility was beyond the scope of this study, satisfactory results have been reported.<sup>8</sup>

Both VCSS and CEAP clinical score changes were significantly higher in comparison with those of CEAP clinical class, which is considered rather static. Although we

found CEAP clinical class nonsensitive in measuring venous outcome, we still consider CEAP clinical class useful in classifying clinical stages. This was also the intention of the VSS inventors, to complement the current CEAP system.<sup>7</sup> VDS changes were found to be superior to all other scores; however, this finding needs to be treated with caution, because patient expectations to be compression-free might be a potential bias toward no use of elastic compression. Nevertheless, VDS is simple and probably has a strong relation with quality of life. VSS neither takes into account quality of life issues nor intends to substitute the specially designed quality of life questionnaires. Our opinion is that neither system is superior and that a new, hybrid system needs to be devised. Quality of life is not always affected, and in those cases these systems are not useful.

In conclusion, clinical severity scores, especially the new VCSS, are useful tools for assessing venous outcome. Compared with CEAP clinical score, VCSS has the additional advantage of correlating better with VSDS, a measure of the anatomic pattern of venous disease. Further modifications in VCSS might increase its sensitivity in monitoring outcome of venous surgery. Although use of the relatively simple CEAP clinical class might be adequate for daily clinical purposes, venous severity scoring systems should be used in clinical studies to quantify venous outcome.

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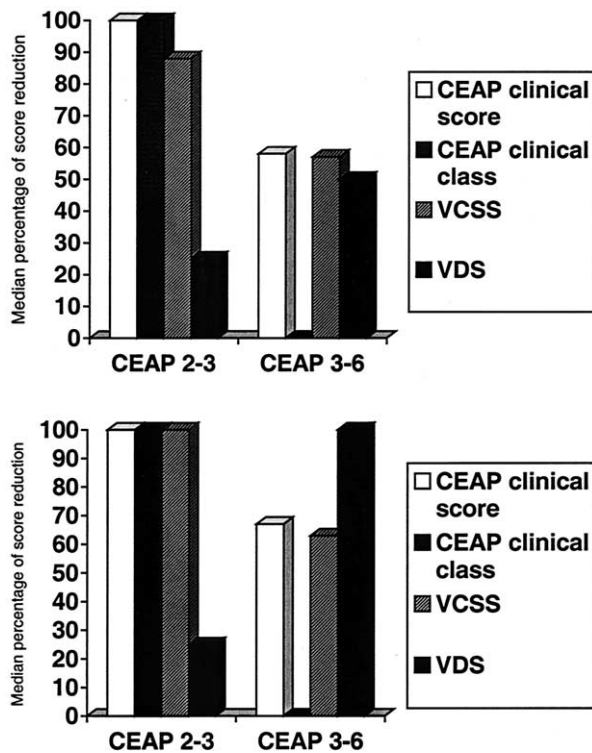


Fig 5. *Top*, Percent change in CEAP clinical score and class, venous clinical severity score (VCSS), and venous disability score (VDS), at 6 weeks after surgery. Patients were stratified according to CEAP clinical class. *Bottom*, Percent change in CEAP clinical score and class, VCSS, and VDS, at 6 months after surgery. Patients were stratified according to CEAP clinical class.

**Table I, online only. CEAP clinical class categories**


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Class 0: no visible or palpable signs of venous disease  
 Class 1: telangiectases, reticular veins, malleolar flare  
 Class 2: varicose veins  
 Class 3: edema  
 Class 4: skin changes ascribed to venous disease  
 Class 5: skin changes in conjunction with healed ulceration  
 Class 6: skin changes in conjunction with active ulceration

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**Table II, online only. CEAP clinical score**

| <i>Attribute</i>     | <i>Score</i> |  |                                  |
|----------------------|--------------|--|----------------------------------|
|                      | <i>0</i>     | <i>1</i>                               | <i>2</i>                         |
| Pain                 | None         | Moderate, not necessitating analgesics | Severe, necessitating analgesics |
| Edema                | None         | Mild or moderate                       | Severe                           |
| Venous claudication  | None         | Mild or moderate                       | Severe                           |
| Pigmentation         | None         | Localized                              | Extensive                        |
| Lipodermatosclerosis | None         | Localized                              | Extensive                        |
| Ulcer diameter (cm)  | None         | <2                                     | ≥2                               |
| Ulcer duration (mo)  | None         | <3                                     | ≥3                               |
| Ulcer recurrence     | None         | Once                                   | More than once                   |

**Table III, online only.** Attributes of new venous clinical severity score\*

| <i>Attribute</i>                 | <i>Absent = 0</i>                  | <i>Mild = 1</i>  | <i>Moderate = 2</i>   | <i>Severe = 3</i>   |
|----------------------------------|------------------------------------|--|---|---|
| Pain                             | None                               | Occasional, not restricting activity or requiring analgesics | Daily, moderate activity limitation, occasional analgesics                                  | Daily, severe, limiting activities or requiring regular use of analgesics |
| Varicose veins <sup>†</sup>      | None                               | Few, scattered; branch varicose veins                        | Multiple: GS varicose veins confined to calf or thigh                                       | Extensive: Thigh <i>and</i> calf or GS <i>and</i> LS distribution         |
| Venous edema <sup>‡</sup>        | None                               | Evening ankle edema only                                     | Afternoon edema, above ankle  | Morning edema above ankle and requiring activity change, elevation        |
| Skin pigmentation <sup>§</sup>   | None or focal, low intensity (tan) | Diffuse but limited in area, and old (brown)                 | Diffuse over most of gaiter distribution (lower 1/3) <i>or</i> recent pigmentation (purple) | Wider distribution (above lower 1/3) <i>and</i> recent pigmentation       |
| Inflammation                     | None                               | Mild cellulitis, limited to marginal area around ulcer       | Moderate cellulitis, involving most of gaiter area (lower 1/3)                              | Severe cellulitis (lower 1/3 and above) or significant venous eczema      |
| Induration                       | None                               | Focal, circumalleolar (<5 cm)                                | Medial or lateral, less than lower third of leg   | Entire lower third of leg or more   |
| No. of active ulcers             | 0                                  | 1  | 2   | >2  |
| Active ulceration, duration      | None                               | <3 mo  | >3 mo, <1 y   | Not healed >1 y   |
| Active ulcer, size <sup>  </sup> | None                               | <2 cm diameter   | 2-6 cm diameter   | >6 cm diameter  |
| Compressive therapy <sup>¶</sup> | Not used or not compliant          | Intermittent use of stockings                                | Use of elastic stockings most days  | Full compliance: stockings plus elevation                                 |

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GS, Greater saphenous vein; LS, lesser saphenous vein.

\*Proposed by American Venous Forum Ad Hoc Committee on Venous Outcomes Assessment.

<sup>†</sup>“Varicose” veins must be >4 mm in diameter to qualify, so that differentiation is ensured between C1 and C2 venous disease.

<sup>‡</sup>Presumes venous origin by characteristics (eg, brawny [not pitting or spongy] edema), with significant effect of standing or limb elevation or other clinical evidence of venous cause (ie, varicose veins, history of deep venous thrombosis). Edema must be a regular finding (eg, daily occurrence). Occasional or mild edema does not qualify.

<sup>§</sup>Focal pigmentation over varicose veins does not qualify.

<sup>||</sup>Largest dimensions diameter of largest ulcer.

<sup>¶</sup>Sliding scale to adjust for background differences in use of compressive therapy.