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ABSTRACT

Objective: To determine the effects of graduated and progressive elastic compression stockings (ECS) on postural diameter changes and viscoelasticity of leg veins in healthy controls and in limbs with chronic venous disease (CVD).

Methods: In 57 patients whose legs presented with C_{1s}, C_3, or C_5 CEAP classes of chronic venous disease and were treated primarily with compression, and 54 healthy controls matched for age and body mass index, we recorded interface pressures (IFP) at 9 reference leg levels. Cross-sectional areas of the small saphenous vein (SSV) and a deep calf vein (DCV) were measured with B-mode ultrasound with patients supine and standing, recording the force (PF) applied on the ultrasound probe to collapse each vein with progressive ECS, and with and without graduated 15 to 20 mm Hg and 20 to 36 mm Hg elastic stockings. We chose these veins because they were free of detectable lesion and could be investigated at the same level (mid-height of the calf), and their compression by the ultrasound probe was not hampered by bone structures.

Results: IFP decreased from ankle to knee with graduated 15 to 20 and 20 to 36 mm Hg, but increased with progressive ECS, and were 8.4 to 13.8 mm Hg lower for C_{1s} than for control or C_3 and C_5 limbs. Without ECS, the SSV median [lower-upper quartile] cross-sectional area was 4.9 mm^2 [3.6-7.1 mm^2] and 7.1 mm^2 [3.0-9.9 mm^2] in C_3 and C_5 limbs versus 2.9 mm^2 [1.8-5.2 mm^2] and 3.8 mm^2 [2.1-5.4 mm^2] in controls ($P < .01$), respectively, while supine and standing. It remained greater in C_3 and C_5 than in C_{1s} and control limbs wearing any ESC. Wearing compression, especially with progressive ECS, decreased the SSV and DCV cross-sectional area only with patients supine, thus decreasing postural changes, which remained highly diverse between individuals. The SSV cross-sectional area versus PF function traced a hysteresis loop of which the area, related to viscosity, was greater in C_3 and C_5 limbs than controls, even with graduated 15 to 20 or 20 to 36 mm Hg ECS. Progressive ECS decreased vein viscosity in the supine position, whereas 20 to 36 mm Hg and progressive ECS increased distensibility in the standing position.

Conclusions: ECS decrease the cross-sectional area of SSV and DCV with patients supine, but not upright. C_{1s} limbs show distinctive features, especially regarding IFP. Graduated 20 to 36 mm Hg and progressive stockings lower viscosity and increase distensibility of the SSV. (J Vasc Surg Venous Lymphat Disord 2022;10:186-195.)

Keywords: Chronic venous disease; lower limb veins; Compression therapy; Viscoelasticity; Ultrasound examination

Compression therapy remains the cornerstone of the medical treatment of chronic venous disease (CVD). Although it is a very ancient technique, unproven dogmas and misconceptions are common but challenged by recent data.[1-3] There is a growing consensus that further studies are necessary to assess its mechanisms, indications, and optimal parameters.

Compression therapy may be beneficial by increasing interstitial pressure, thus decreasing venous wall stress and/or improving blood flow. According to Laplace's

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Clinical Trial Registration—URL: https://clinicaltrials.gov/ct2/show/NCT01558024

Additional material for this article may be found online at www.jvsvenous.org

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equation, decreasing the transmural pressure, decreasing the diameter, or increasing wall thickness, decreases venous wall stress. Standing motionless (orthostasis) results in high blood pressure in leg veins, which can be decreased by walking, activating the calf muscle pump.[4] Elastic compression stockings (ECS) decrease the transmural venous pressure, even if they do not decrease the cross-sectional area.[4] Moreover, postural changes in the vein cross-sectional area show great interindividual diversity among patients with CVD, as well as among healthy patients.[5]

Graduated compression stockings apply greater pressure at the ankle than at the calf. Conversely, progressive stockings, as used in sports, exert the higher pressure at the calf, with a greater impact on the calf venous muscle pumping function.[6] Their benefit in patients with CVD whose valves are often incompetent and who suffer mostly when standing motionless remains to be investigated thoroughly.

The cross-sectional area changes of the small saphenous vein (SSV), measured with B-mode ultrasound examination and plotted as a function of applied force on the ultrasound probe to achieve vein collapse, trace a hysteresis loop,[5,7] of which the slope is related to elasticity and the area to viscosity.[8,9] We used this technique, together with postural changes and interface pressure (IFP) measurements, to compare the effects of graduated and progressive ECS on the SSV and on a deep calf vein (DCV) in limbs with CVD, where compression was the primary therapy, and in normal controls. We chose these veins because they were free of detectable lesion and could be examined at the same level (mid-height of the calf), whereas their compression by the ultrasound probe was not hindered by bone structures.

ARTICLE HIGHLIGHTS

- **Type of Research:** Single-center case-control clinical research
- **Key Findings:** In 57 limbs with chronic venous disease and 54 controls, compression stockings failed to decrease the small saphenous and deep calf vein diameter in the standing position. Interface pressures were lower than expected in C_{1s} limbs. Graduated 20 to 36 mm Hg and progressive stockings lowered small saphenous vein viscosity but increased distensibility.
- **Take Home Message:** The noninvasive measurement of interface pressures and leg vein viscoelasticity should contribute to determining personalized parameters of compression stockings.

METHODS

Population sample. This study was conducted in the 57 patients with CVD (41 females) and 54 controls (36 females) recruited for the *Phlebosthene* study.[5] The examined limb was in the C_{1s} (telangiectasia or reticular veins and symptoms) CEAP category[10] in 21 patients (with superficial vein reflux in 3 and obstruction in 1), C_3 (edema) in 18 (with superficial venous reflux in 4), and C_5 (healed venous ulcer) in 18 patients (with lipodermatosclerosis in 11, superficial venous reflux in 5, deep venous reflux in 3, and obstruction in 1). None of the C_{1s} and C_3 limbs had varicose veins or skin changes. CVD was diagnosed after other possible causes of signs or symptoms had been excluded by detailed and independent clinical and ultrasound examinations performed by two physicians. Healthy biomedical research volunteers were recruited from the general population by the Montpellier Center for Clinical Investigation to form the control group. They were matched for age and body mass index with patients.[5] Pregnant or breastfeeding women, patients less than 18 years old, and patients unable or unwilling to provide their consent form were not included. Intravenous and intramuscular pressure measurements were proposed at inclusion until 18 of the patients with CVD (6 in each CEAP category) and 18 of the controls agreed.[5]

The Ethics Committee (CCP-Sud-Méditerranée—RCB-2014-A00737-40) approved the study. Written informed consent was obtained from all patients.

We performed ultrasound examinations with a Logiq-e system (GE-Ultrasound, Chicago, Ill), of which the 12L-RS linear probe was equipped with a XFTC300 sensor connected to an ARD154 amplifier (Measurement Specialties, Hampton, Virgin Islands) to measure the force (PF) applied on the ultrasound probe by the operator when compressing the vein. The ultrasound video signal was captured by a Picolo frame-grabber (Euresys, Liege, Belgium).[7]

For intramuscular pressure measurement, a 1.2-mm external diameter IMP-Cath catheter (Alcis, Besançon, France), was inserted, after local anesthesia by 6 to 8 mL of 5 mg/mL lidocaine, into the medial gastrocnemius muscle just above the level of the calf maximum circumference, and introduced at a depth of approximately 4 cm. For intravenous blood pressure measurement, a 22G Cathlon catheter (Smiths-Medical, St-Paul, Minn) was inserted into the great saphenous vein at mid-calf.[5] IFPs were measured with nine Kikuhime sensors (Medigroup, Melbourne, Australia) positioned between the garment and the skin at European norm AFNOR-NFG-G30-102B reference levels (Fig 1). Sensors were calibrated at atmospheric pressure and at 100 mm Hg with a mercury column before each session.

Catheters and sensors were connected to DPT-6000 transducers (Codan-Medical, Lensahn, Germany), and analogue signals were transmitted, through UIM100C interface modules, to a MP150 system for processing and analysis with Acqknowledge-V4.2 (Biopac-Systems, Goleta, Calif).[5]

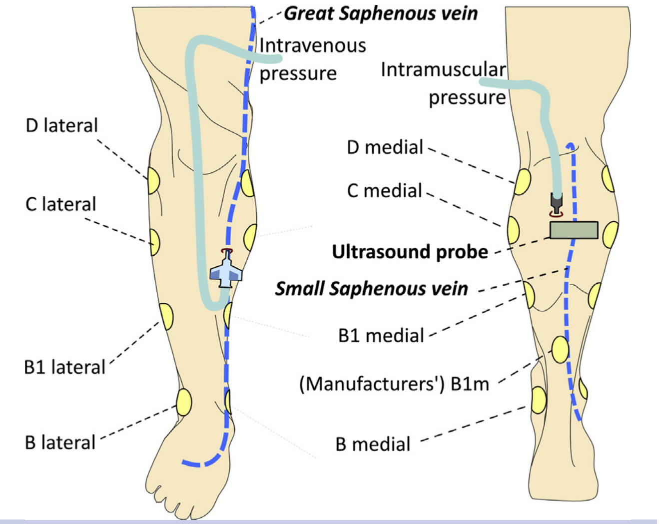

Fig 1. Location of catheters and interface pressure (IFP) sensors. Front and back views showing the intravenous catheter in the great saphenous vein, the intramuscular catheter in the triceps surae muscle, the IFP sensors at the nine reference levels on the leg, and the site of ultrasound examination.

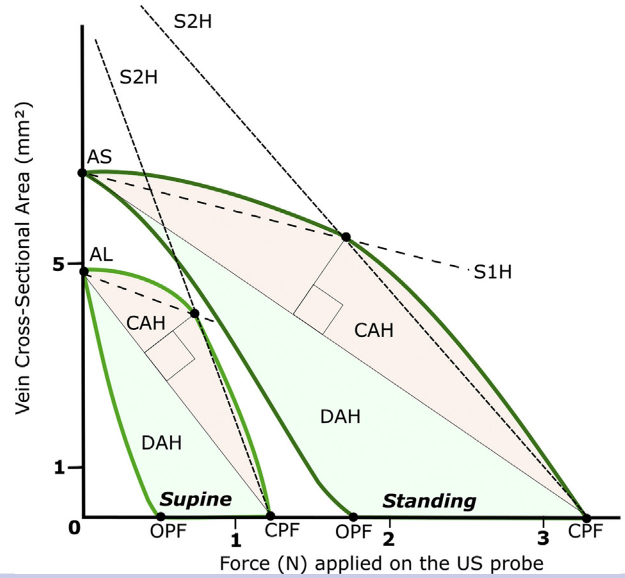

Fig 2. Typical hysteresis loops showing the small saphenous vein (SSV) cross-sectional area as a function of the force applied on the ultrasound probe during the compression test. Legend: Cross-sectional area (in mm^2) plotted as a function of the force (in N) exerted by the operator on the ultrasound probe. *AL,* Maximum cross-sectional area in the supine position; *AS,* maximum cross-sectional area in the standing position; *CPF,* vein-closing probe force; *OPF,* vein-opening probe force; *CAH and DAH,* area of the compression and decompression parts, respectively, of the loop; *S1H and S2H,* first and second slopes, respectively, of the compression part of the loop. In this example, the area of the loop is smaller, and the slope S2H steeper in the supine than in the standing position.

Protocol. A thin knee-long nylon garment kept the catheters and sensors in place. The patient was resting on one side (lateral decubitus) while the contralateral (upper) leg was investigated, and a small wedge was placed under the heel to avoid any contact or pressure on calf muscles. On the SSV at mid-calf, then on a DCV (the soleus or one of the gastrocnemius veins, as available) at the same calf level, the observer compressed the vein by increasing progressively PF until the vein collapse was obtained, then decreased PF until the vein reopened completely, at a rate of 0.25 to 1 cycle/s for 6 to 8 cycles. Thereafter, the patient stood motionless for 1 minute before the compression test was repeated while the contralateral leg supported the body weight. Finally, the patient performed a tiptoe test at a rate of 0.25 to 1.00 cycle/s. This protocol was successively performed with the patient wearing no ESC, a 15 to 20 mm Hg graduated VeinoStim, a 20 to 36 mm Hg graduated VeinoStim, and a progressive Progressiv' ECS (Pierre-Fabre Laboratories, Castres, France). Graduated 15 to 20 mm Hg and 20 to 36 mm Hg ECSs were designed to apply a 15 to 20 mm Hg and 20 to 36 mm Hg pressure at the ankle, respectively (French norm AFNOR-NFG-G30-102B). Progressive ECSs were designed to apply a pressure of 7 mm Hg at the ankle and 25 mm Hg at the calf. The ECS size was chosen to fit the patients' ankle minimal circumference (B-level), calf maximal circumference (C-level) (Fig 1) and leg length according to the manufacturer's recommendations. Each test was performed only once during the session, which lasted from 90 minutes without to 150 minutes with invasive measurements. Ultrasound examinations were performed with a large amount of contact gel soaking the weaving.

Variables. Signals were recorded after stabilization at each step. Independent observers blinded from the patient's status measured, on recorded signals and images, the maximum PF applied during the SSV and the DCV compression test, intravenous pressure (IVPm) and intramuscular pressure averaged over about 10 seconds at rest, and the lower IVPm value reached at the end of the tiptoe-test movements (IVPmin). Using the fit-ellipse function of *Fiji* image-processing software (https://fiji.sc/), the SSV and DCV cross-sectional area was measured in the supine and in the standing position. Postural change in cross-sectional area (PAC) was calculated as 100 × (standing−supine)/standing. For comparisons between leg levels, groups, and ECSs, IFP values provided by the lateral and medial sensors at the B, B1, C, and D levels were averaged.

From the SSV hysteresis loop,[8] were automatically extracted (Fig 2)[7]:

1. Pressure-related variables: PF at vein collapse and reopening;
2. Viscosity-related variables: total area of the loop, area of its compression and of its decompression phase; and
3. Elasticity-related variables: slope of the first (S1H) and second (S2H) part of the compression phase.

Table. Biometrics of the population sample

	Controls (n = 54)	C_{1s} (n = 21)	C_3 (n = 18)	C_5 (n = 18)
Age, years	63.5 [53.0-70.0]	61.0 [44.0-72.0]	61.0 [52.3-67.0]	66.0 [60.0-76.5]
Weight, kg	63.0 [60.0-74.5]	63.0 [58.5-80.0]	79.0 [64.0-88.5]	82.0 [68.5-111.5]
Height, cm	164.5 [160.0-169.8]	162.0 [157.0-170.0]	166.5 [161.0-170.0]	169.0 [164.0-180.5]
BMI, kg.m^{-2}	24.8 [21.5-27.3]	25.6 [21.5-28.5]	29.0 [23.0-33.1]	27.3 [22.6-36.4]
Leg length, cm	42.0 [39.0-43.5]	40.0 [39.0-42.0]	41.0 [39.6-42.0]	43.0 [41.5-44.0]
Calf circumference, cm	34.8 [32.9-37.0]	35.8 [34.0-37.0]	38.5 [36.3-42.7]	37.0 [32.5-40.5]
Ankle circumference, cm	21.0 [20.0-22.0]	21.8 [20.8-23.4]	23.8 [22.2-25.4]	23.1 [22.0-25.9]

Age, body weight, height, BMI, leg length, calf circumference, and ankle circumference of normal lower limbs (controls) and in limbs with C_{1s}, C_3, and C_5 CEAP category of chronic venous disease. Values are reported as median [lower-upper quartile]. *BMI,* Body mass index.

Statistical analysis. Continuous variables are reported as median [lower-upper quartile]. Differences between two groups and changes within one group were evaluated with Wilcoxon-Mann-Whitney (independent data) and with Wilcoxon signed-rank test (paired data), respectively. Differences between controls, C_{1s}, and pooled C_3 and C_5 limbs ($C_{3\&5}$), and between ECSs, were evaluated with Kruskal-Wallis and Friedman tests, respectively, after which Dunn's multiple comparison test was used to control for alpha risk when comparing groups or compression stockings two by two. *P* values of less than .05 were considered significant. Intraobserver reproducibility was evaluated on two independent readings of the same recorded images or signals by Lin concordance correlation coefficient (ρc).

Statistical analyses were performed using Prism-V.5 (GraphPad, San Diego, CA) and R-V3.5.1 (R-Foundation for Statistical Computing, Vienna, Austria).

RESULTS

Population sample. There was no difference in age or body mass index between patients with CVD and controls, but C_5 patients had greater weight and height than controls and C_{1s} patients. C_3 limbs showed greater calf circumference than controls, whereas C_3 and C_5 limbs had greater ankle circumference than controls (Table).

Intravenous and intramuscular pressure. Without ECS, there was no IVPm difference between groups in the supine position but $C_{3\&5}$ patients had greater (P = .003) IVPm (60.1 [55.8-71.8]) mm Hg than controls (46.7 [−6.6 to 57.9]) in the standing position. The IVPm difference between the supine and the standing position correlated positively with height (Spearman r = 0.49; P = .008) in the whole population sample. The IVPm was greater with progressive than without ECS in the supine position, and greater in the standing than in the supine position without or with any ECS (Supplementary Material, Supplementary Table I online only). The IVPmin was slightly lower without than with graduated 15 to 20 mm Hg or progressive, and with graduated 15 to 20 mm Hg than 20 to 36 mm Hg ECS (Supplementary Material, Supplementary Table II online only).

The mean intramuscular pressure was similar in controls and limbs with CVD in the supine position, with or without ECS, but higher in limbs with CVD without and with progressive ECS in the standing position. It increased gradually from without to graduated 15 to 20 mm Hg, graduated 20 to 36 mm Hg, and progressive ECS in all groups and both positions (Supplementary Fig 1; Supplementary Material, Supplementary Table III online only).

Interface pressures. Intraobserver reproducibility of IFP readings yielded a ρc of 0.9489 to 0.9996 for the different stages of the procedure (Supplementary Material,Supplementary Table IV online only).

IFPs were about 4 mm Hg without ECS (under the nylon garment), and increased with ECSs, reaching a maximum at the B1m-level then decreasing toward the D-level with graduated 15 to 20 mm Hg and 20 to 36 mm Hg, but reaching a maximum at the C-level with progressive ECS (Fig 3, Supplementary Material, Supplementary Tables V and VI online only). The IFPs were 8.4 to 13.8 mm Hg lower in C_{1s} than in $C_{3\&5}$ limbs and controls at all levels. The IFPs were different between no ECS, graduated 15 to 20 mm Hg, graduated 20 to 36 mm Hg, and progressive ECSs (Supplementary Material, Supplementary Table VII online only).

The IFPs with ECSs were greater standing than supine except at the D-level (Supplementary Material, Supplementary Table VIII online only). There were greater differences between the lateral and the medial sensors in controls than in limbs with CVD, especially C_{1s} limbs when standing and at the ankle (Supplementary Material, Supplementary Table IX online only).

Vein cross-sectional area. The SSV and DCV cross-sectional area could be measured at every stage of the procedure in 111 and 107 patients, respectively. In both positions, controls had smaller SSV cross-sectional area than $C_{3\&5}$ limbs, without and with any ECS. In the supine position with progressive ECS, controls had smaller DCV cross-sectional area than C_{1s} and $C_{3\&5}$ limbs (Supplementary Fig 2, Supplementary Material,

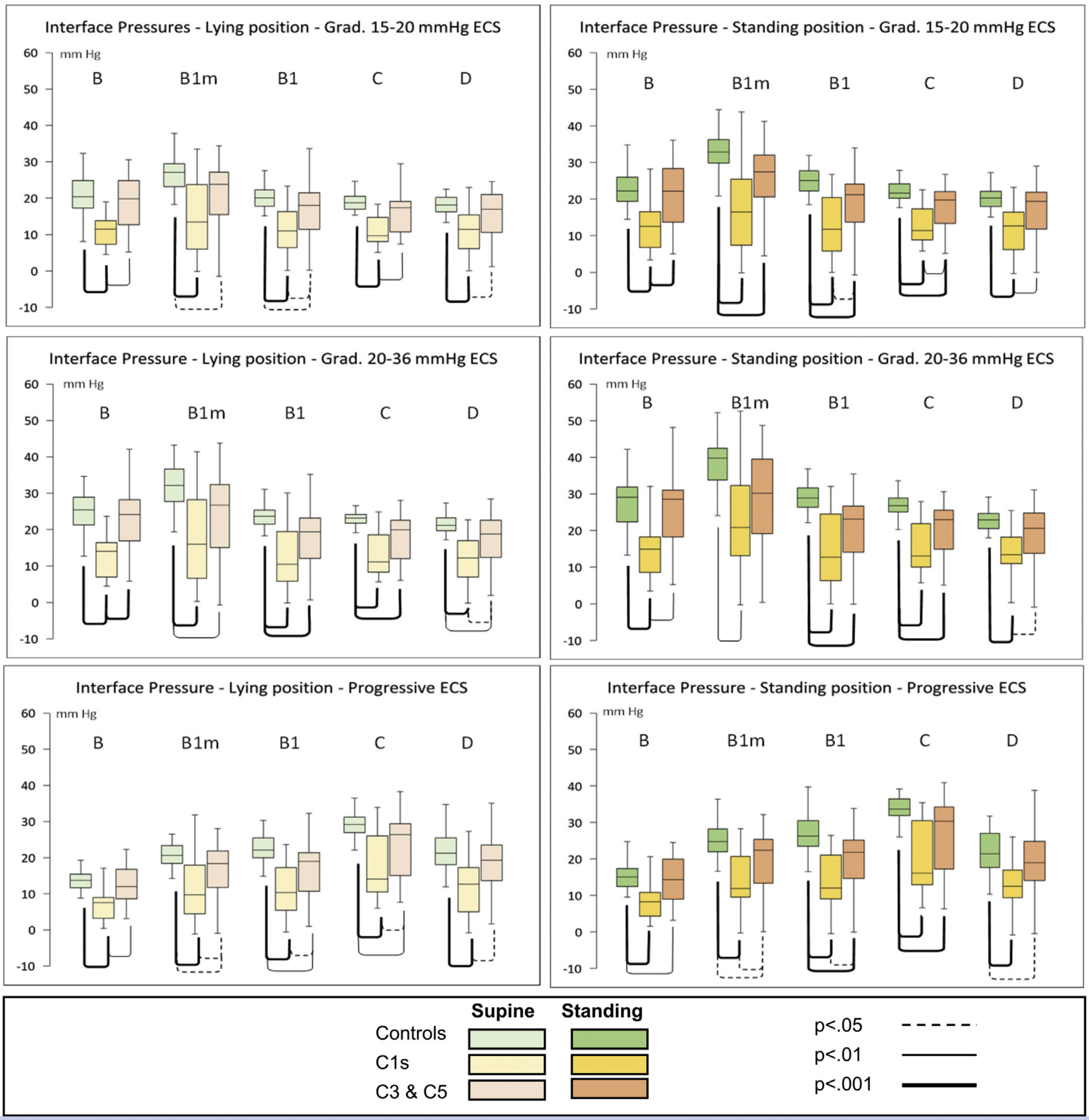

Fig 3. Interface pressures (IFP). Box-and-whiskers plots of IFPs (in mm Hg) in the lower limbs of normal controls, in limbs with C_{1s}, and in limbs with C_3 or C_5 CEAP category of chronic venous disease (CVD) with graduated 15 to 20 mm Hg and 20 to 36 mm Hg, and with progressive compression stockings at the B, B1m, B1, C, and D reference leg levels (values provided by the lateral and medial sensors were averaged at the B, B1, C, and D levels). Significance of differences between groups (Dunn's multiple comparison test post Kruskal-Wallis analysis of variance) is shown as brackets.

Supplementary Table X online only). Body mass index was slightly higher in males but males and females had similar SSV or DCV cross-sectional area (Supplementary Material, Supplementary Table XI online only).

In the supine position, SSV and DCV cross-sectional area was smaller with progressive than with graduated 15 to 20 mm Hg or no ECS in controls and in $C_{3\&5}$ limbs, and DCV cross-sectional area was smaller with any ECS than without in controls. In the standing position, ECS produced no significant changes in SSV and DCV cross-sectional area (Supplementary Material, Supplementary Table XII online only).

The vein cross-sectional area was greater in the standing than in the supine position without or with any ECS in all groups for SSV, and in controls for DCV. ECSs increased SSV PAC, but this increase was significant only in controls with progressive ECS. DCV-PAC increased with all ECSs in controls, and with progressive ECS in $C_{3\&5}$ limbs (Fig 4, Supplementary Material, Supplementary Tables XIII and XIV online only).

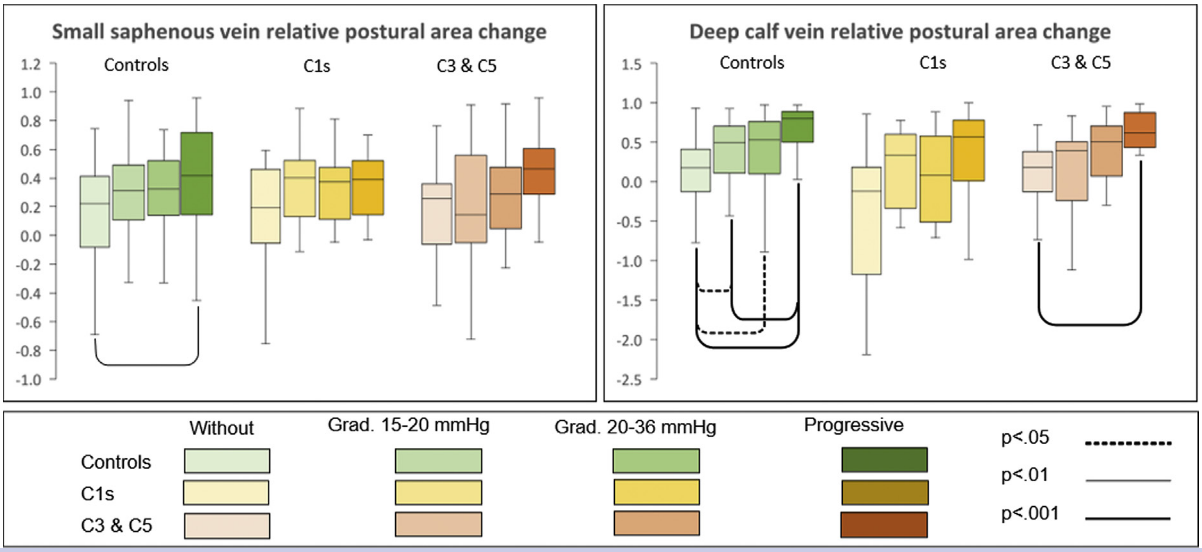

Fig 4. Relative postural change in cross-sectional area of the small saphenous vein (SSV) and the DCV. Box-and-whiskers plot of the relative change in cross-sectional area of the SSV and of the DCV when changing from the lying to the standing position, in normal controls, in limbs with C_1s, and in limbs with C_3 or C_5 CEAP category of CVD, without, with graduated 15 to 20 mm Hg and 20 to 36 mm Hg, and with progressive compression stockings. Differences between elastic compression stockings (ECS; Dunn's multiple comparison test post Friedman analysis of variance) are shown as horizontal brackets when significant.

Viscoelasticity. The force that collapsed the SSV and the DCV was greater in the standing than in the supine position, without or with any ECS (Supplementary Fig 3, Supplementary Material, Supplementary Tables XV and XVI online only). In the supine position, a greater force was required to collapse the DCV than the SSV in all groups without ECS and in $C_{3\&5}$ limbs with any ECS. In the standing position, a greater force was required to collapse the DCV than the SSV without or with any ECS in all groups except in C_{1s} with progressive ECS (Supplementary Material, Supplementary Table XVII online only).

All hysteresis loop variables were increased when changing from the standing to the supine position, without or with any ECS. All ECSs decreased S2H in the supine but not in the standing position. The vein-opening probe force increased with graduated 15 to 20 mm Hg stockings, but not with graduated 20 to 36 mm Hg, and decreased with progressive stockings. Progressive stockings decreased the total area of the loop and the area of its compression part in both positions. Wearing an ECS did not alter the differences in hysteresis variables between the groups. Graduated 20 to 36 mm Hg and progressive stockings reversed the postural change of S2H in controls, C_{1s}, and $C_{3\&5}$ limbs (Fig 5, Supplementary Material, Supplementary Tables XVIII and XIX online only).

DISCUSSION

The main findings of this study were that (1) IFP followed the expected pattern (decreasing with graduated ECSs or increasing with progressive ECSs) from the ankle to the knee, but were lower in C_{1s} than in other limbs. They increased in the standing position in all patients without and with any ECS. (2) The SSV cross-sectional area was greater in $C_{3\&5}$ limbs than in controls in both positions without and with ECSs, whereas the DCV cross-sectional area was greater in $C_{3\&5}$ and C_{1s} limbs than in controls only in the supine position. All ECSs decreased the cross-sectional area of both veins in the supine, but not significantly in the standing position. Progressive ECS produced the greater changes. (3) A greater force had to be applied on the ultrasound probe to collapse the DCV than the SSV, especially in the standing position and in $C_{3\&5}$ patients. (4) SSV viscoelasticity variables were greater in $C_{3\&5}$ limbs than in controls in the standing position without ECS and greater in the standing than in the supine position in all patients. ECSs did not change the viscoelasticity differences between the groups. Progressive ECS decreased the viscosity variables in controls and $C_{3\&5}$ patients in the supine position. Graduated 20 to 36 mm Hg and progressive ECS reversed postural changes in elasticity variables, resulting in greater distensibility.

Although not different between groups in the supine position, intramuscular pressure decreased in the standing position, in agreement with previous reports,[11] and became higher in limbs with CVD without ECS and with progressive ECS. Logically, it increased gradually, in both positions, with graduated 15 to 20 mm Hg, 20 to 36 mm Hg, and progressive ECS. As expected,[12,13] the IVPm was higher in $C_{3\&5}$ limbs than in controls in the

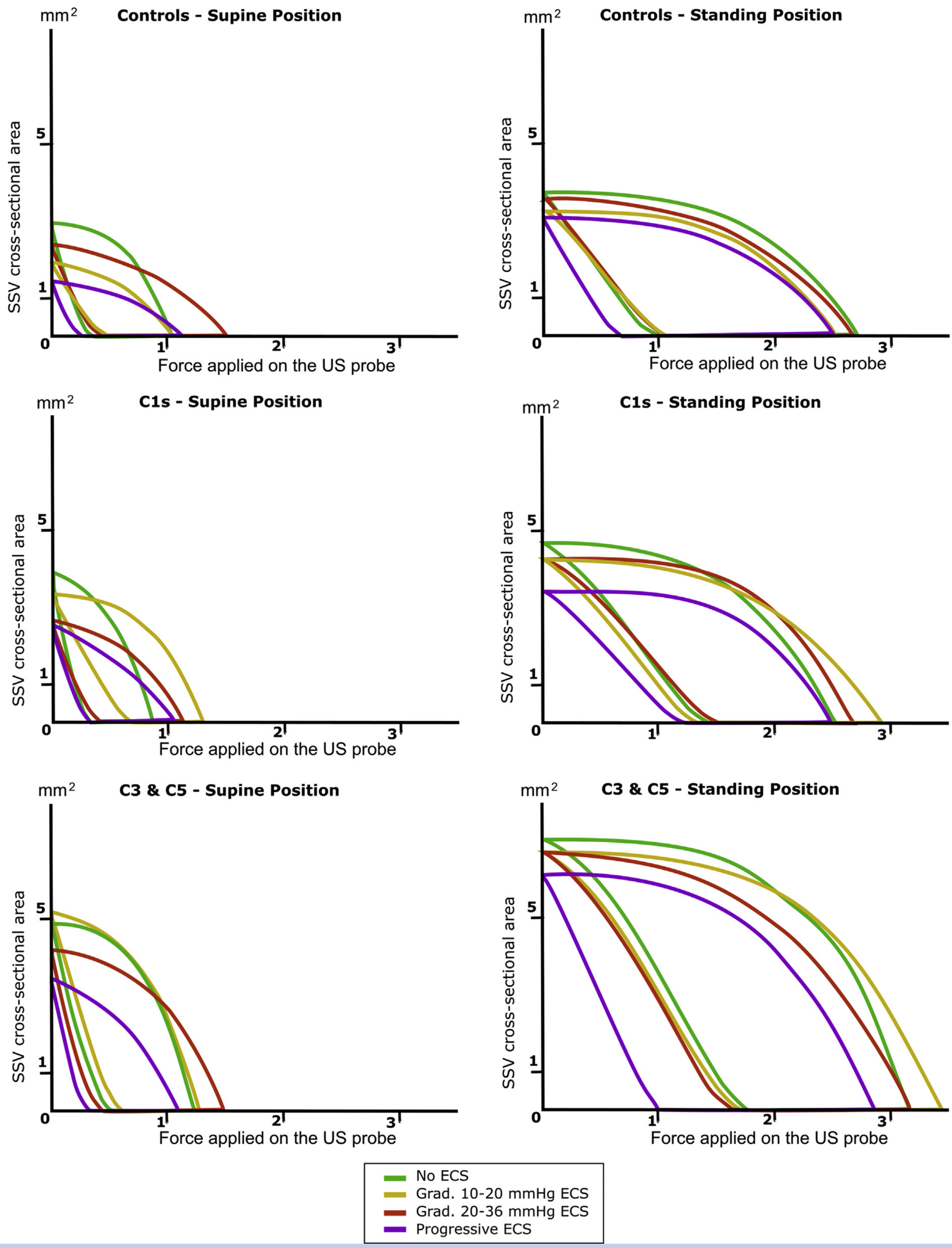

Fig 5. Hysteresis loops drawn from the median values obtained in controls and in limbs with chronic venous disease (CVD) in the supine and in the standing position without and with elastic compression stockings (ECS). Loops drawn using the median values in controls and in limbs with C_{1s} and with C_3 or C_5 CEAP category of CVD, without and with graduated 15 to 20 mm Hg, graduated 20 to 36 mm Hg, and progressive compression stockings.

standing position without ECS, but this difference was no longer significant with ECS. In contrast with limbs with CVD, venous pressure showed large interindividual differences in control limbs in orthostasis, where segmentation of the blood column by competent valves and/or venoconstriction may occur. Venous pressure at the ankle increases in proportion to hydrostatic pressure[14-16] when changing from the supine to the standing position, even with stockings of any class, as long as the patient remains motionless (orthostasis). The benefit of compression garments seems to occur when the patient starts walking, decreasing the IVPm at the ankle if venous valves are competent.[17]

The IFP were within the prescribed range at the ankle in controls and $C_{3\&5}$ limbs with graduated 15 to 20 mm Hg and 20 to 36 mm Hg, and at the calf with progressive ECS. However, they were markedly below the required value in C_{1s} limbs, whatever the stocking. Because the stocking size was chosen according to the patients' biometrics, following the manufacturer's recommendations, this finding cannot be explained by leg dimensions. Skeletal muscle hypotony[18] may have been involved in C_{1s} limbs, as suggested by the lower IFP difference we observed between the lateral and medial sensors. Edema in C_3, and dermatosclerosis in C_5 limbs may have contributed to the loss of the normal leg shape, also resulting in a lesser IFP difference between the lateral and medial sensors. Topographical heterogeneity of IFPs has been reported previously and has been shown to be affected by variations in limb circumference, emphasizing the need for detailed individual IFP measurements for the prescription and evaluation of ECS.[17]

The larger SSV and DCV cross-sectional area that we observed in $C_{3\&5}$ limbs than in controls in the supine position, although these veins were unaffected, support the hypothesis of a systemic disorder. Wearing ECS decreased the SSV and DCV cross-sectional area only in the supine position, thus increasing the postural change because there was no significant diameter decrease in the standing position. That does not mean that elastic compression does not decrease venous wall stress; it does,[19] but the vein pressure-volume function reaches a plateau at a relatively low transmural pressure, beyond which even large changes in blood pressure no longer translate into obvious diameter changes.[4] Because the intramuscular pressure decreased in the standing position, and because we instructed the patient to avoid leg muscle contraction, deep veins could not benefit from a strong support from surrounding tissues in controls and in C_{1s} limbs, whereas edema and/or lipodermatosclerosis could form an inextensible sleeve around the calf in $C_{3\&5}$ limbs, explaining their higher intramuscular pressure and limiting vein expansion.

A mathematical model showed that the contribution of compression stockings to a diameter decrease in the deep veins is small.[20] Our findings are in agreement with previous studies reporting that 20 to 30 mm Hg graduated compression stockings decreased the SSV and deep leg vein diameter in the supine but not in the standing position.[21] The IFP required to effectively compress leg veins in the standing position is greater than hydrostatic pressure,[22] and would not be tolerated.[23] Graduated 15 to 20 mm Hg compression stockings do not significantly decrease the great saphenous and femoral vein diameter in patients with severe CVD, and a 40 to 60 mm Hg pressure on the thigh is necessary to obtain the required hemodynamic improvement.[24] A meta-analysis of randomized controlled studies comparing stockings concluded that a 10 to 15 mm Hg ankle compression pressure was effective, whereas lower pressures were ineffective and higher pressures of no additional benefit, for the treatment of edema and CVD symptoms.[25] Our findings support the conclusions of Partsch et al regarding the modest effect of ECS on vein diameter,[22,26] and their suggestion that their main benefit lies in reducing edema.[27] Decreasing edema, alleviating venous wall stress, and improving calf pump function are thus different therapeutic goals requiring different compression modalities or parameters. Mathematical models fed with the ultrasound data of patients with varicose veins showed that elastic compression is less efficient than skeletal muscle contraction at decreasing vein diameter,[20] although it actually decreases venous transmural pressure.[19] In the present study, progressive ECS produced the greatest decrease in DCV cross-sectional area.

The force to be applied on the ultrasound probe to collapse the vein was greater in both veins in the standing than in the supine position, which can be partly explained by the increase in hydrostatic pressure as suggested by the relation between IVPm and the patient's height. We expected this force to be lower with ECSs because they increase interstitial pressure, but it was not. We hypothesize that ECSs create a global compartment so that the force exerted on the ultrasound probe must increase the pressure in the whole calf before reaching the required value around the target vein. Under ECS, saphenous veins are submitted to the same external pressure as deeper veins and no longer act as superficial.[28]

SSV viscoelasticity postural changes were more consistent and more marked than those of the cross-sectional area, and their assessment could yield a better contribution to the investigation of CVD. The viscosity component was decreased only by progressive stockings in the supine position. The elasticity component decreased from the supine to the standing position without stockings, meaning a lower distensibility, but increased with graduated 20 to 36 mm Hg and progressive ECS, which seemed to restore distensibility by shifting the pressure-volume curve away from its plateau. ECSs did not, however, overcome differences between CEAP groups.

We found no report regarding the noninvasive evaluation of leg vein viscoelasticity under compression stockings in the available literature, although hysteresis is a major characteristic of compression devices.[29] Ultrasound elastography is a recent technique that has been used to investigate the saphenous veins and demonstrated greater elastic modulus (meaning, paradoxically, lower distensibility) in veins with chronic insufficiency.[30] However, elastography would not have been suitable for the present study, especially in patients with edema and/or skin damage, and through the compression stocking fabric. Moreover, elastography does not assess viscosity.

Limitations. We restricted invasive measurements to patients who agreed to undergo invasive measurements until the recruitment goal of one-third of the examined limbs was reached. Although this number allowed characterizing the population sample in view of the abundant literature about intravenous and intramuscular pressures in CVD,[31,32] it did not allow detailed correlations because of insufficient statistical power. We managed to keep the pressure sensors at the same level as the tip of the intravenous and intramuscular catheters, but going from supine to upright could have introduced small differences, as could have the depth of the intramuscular catheter, which was only approximately determined, and intramuscular pressure has been shown to vary with depth.[33] Regarding IFP, our results are valid only for the specific stockings we tested, and cannot be extrapolated to other classes and brands. The viscoelasticity variables we measured depended not only on the venous wall, but also on the biomechanical characteristics of blood and of surrounding tissues, and further studies are needed to determine the most relevant variables for the clinical usefulness. Preliminary tests showed no significant change in the shape and parameters of the hysteresis loop as long as the cycle period was more than 1 second, but viscosity is frequency dependent and we are considering automatic control of the ultrasound probe drive, which would improve standardization and help in identifying underlying mechanisms, including smooth muscle adaptation. We included limbs with C_{1s}, C_3, and C_5 CEAP category because compression therapy is their first and essential therapy, whereas sclerosis, surgery and interventional techniques are required for C_2 limbs. The C_5 category also represents a stabilized condition when a venous ulcer has been successfully treated and long-term compression therapy is mandatory. However, including C_2 and C_4 categories, which are diagnosed on objective signs, would be necessary for a comprehensive description of biomechanical changes in CVD, as would correlation with venous severity scores.[34,35] Repeating measurements in the same patients to assess nychthemeral, seasonal, or hormonal variations would be most interesting, but was not possible during the present study because longer sessions would have been impractical or intolerable for many patients.

CONCLUSIONS

The IFP generated by ECS could not be accurately predicted on the sole basis of the patient's ankle and calf circumference, especially in C_{1s} limbs that presented with distinct features. Actual IFP measurement and leg tissue evaluation should be mandatory for the personalization of compression stockings. Postural changes in venous diameter neither reflected the category of CVD nor demonstrated the efficiency of ECS, which decreased the diameter of superficial and deep leg veins only in the lying position. However, graduated 20 to 36 mm Hg and progressive compression stockings reduced the SSV viscosity component and restored its distensibility component, without overcoming CEAP-related differences. The noninvasive measurement of leg vein viscoelasticity appears to be a promising technique for the evaluation of limbs with CVD toward optimal personalization of compression therapy.

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AUTHOR CONTRIBUTIONS

Conception and design: SM, JT, CD, AP, MD, IQ
Analysis and interpretation: SM, JT, FV, MD
Data collection: SM, FV, MN, MD
Writing the article: SM, MD
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Final approval of the article: SM, JT, CD, FV, MN, AP, MD, IQ
Statistical analysis: CD, MD
Obtained funding: AP, MD, IQ
Overall responsibility: MD
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APPENDIX (online only).

Supplementary Results and Discussion

Sample size calculation. Based on studies involving 8 to 35 patients and reporting significant differences in venous distensibility[1,2] or hysteresis[3] between patients with CVD and controls, and between young and elderly patients,[4] we estimated that we needed to include for the "Phlebosthene" projet[5] 54 patients with CVD (18 for each CEAP subgroup), and 54 controls (18 in each physical activity subgroup). We measured intravenous and intramuscular pressures in 18 of the patients with CVD and 18 of the controls with the same CEAP or activity repartition.

Reproducibility of ultrasound measurements. As reported in the first "Phlebosthene" article,[5] reproducibility was evaluated on two independent readings of the same recorded image or signal by Lin concordance correlation coefficient (ρc). Intraobserver reading reproducibility of cross-sectional area measurements yielded ρc = 0.988 and 0.985 for the SSV, and 0.878 and 0.955 for the DCV, respectively, in the supine and in the standing position. Intraobserver reading reproducibility ρc ranged from 0.95 to 0.9996 for mean IVPm and 0.956 to 0.9999 for intramuscular pressure along the procedure. Interobserver reading reproducibility ρc was = 0.981 for CPF, 0.845 for OPF, 0.978 for TAH, 0.939 for CAH, 0.897 for DAH, 0.706 for S1H, and 0.897 for S2H.

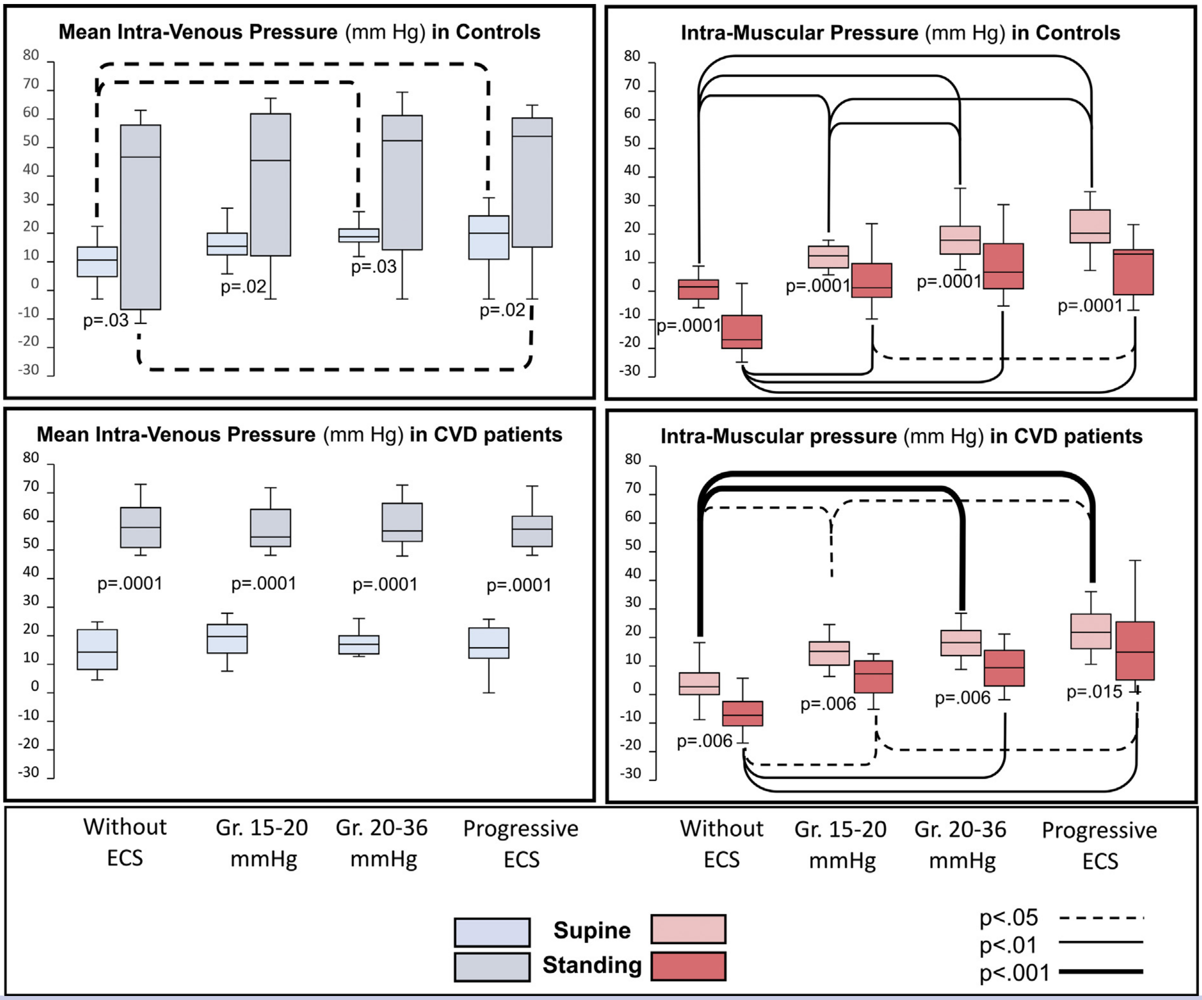
Biometrics. In the whole population sample, the resting mean IVPm correlated positively with height in the standing position (Spearman r = 0.4; *P* = .03), with body weight in the standing position (r = 0.62; *P* = .002), and with body mass index in the supine (r=0.4; *P* = .027) and in the standing position (r = 0.43; *P* = .019). The IVMm difference between the supine and the standing position correlated positively with height (Spearman r = 0.49; *P* = .008).

Intravenous and intramuscular pressure. There was no difference in mean IVPm between groups in the supine position. In the standing position, C_3 and C_5 limbs showed mean IVPm values significantly (*P* = .003) higher (median, 60.1 mm Hg) than controls (median, 46.7 mm Hg) and nonsignificantly higher than C_{1s} (median, 50.0 mm Hg) in the standing position.

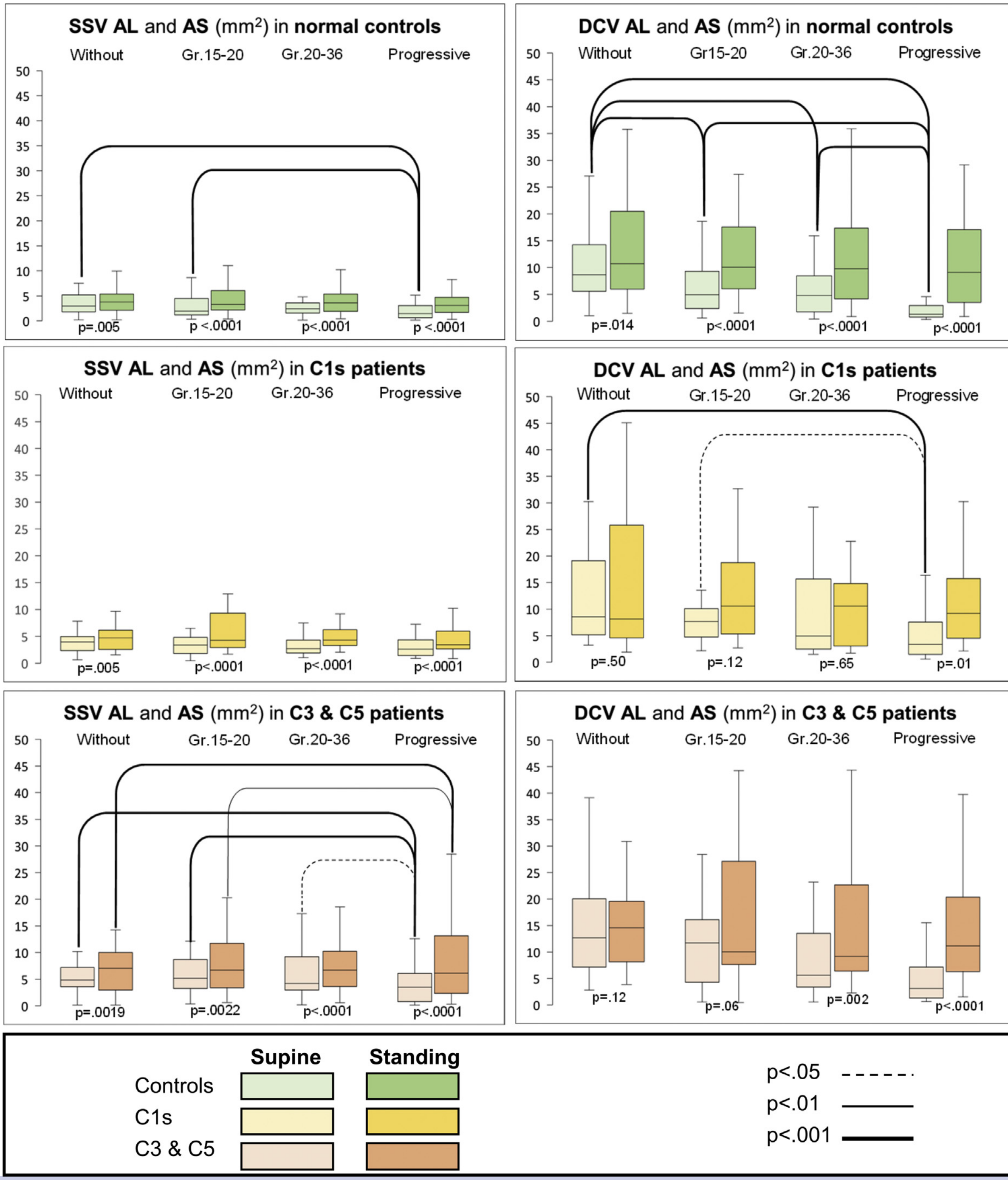
Compression stockings induced a modest but significant increase in intramuscular pressure (in the expected order: without stockings < graduated class 2 stockings < graduated class 3 stockings < progressive stockings) in both positions. In contrast, IVPm, although significantly and markedly greater in the standing than in the supine position, was similar without and with any compression stockings in either position. Ambulatory venous pressure has long been acknowledged as a marker of venous insufficiency, whereas venous pressure at the ankle in orthostasis has been shown to depend on hydrostatic pressure.[6-9] Thus, the increase in IVPm in the standing position reflects the change in hydrostatic pressure, which is the same with or without stockings of any class as long as the patient remains motionless. The benefit of compression garments appears when the patient starts walking, decreasing the IVPm at the ankle (ambulatory venous pressure) if venous valves are competent. IVPm at the ankle in the standing position is not influenced by the presence or absence of reflux as long as the patient remains immobile (orthostasis), but the ambulatory venous pressure[6-8] is higher in limbs with venous reflux.[10] However, the ambulatory dorsal foot venous pressure may not always reflect deep (tibial and popliteal) venous pressure.[11] ECS have been shown to have no significant effect in healthy patients, and a modest effect on ambulatory venous pressure in patients with deep venous insufficiency.[12] This supports the conclusion of Partsch[13] suggesting that the main benefit of ECS lies in reducing edema rather than venous wall stress.

Viscoelasticity of the vessel wall. Several in vitro studies of arterial and venous wall specimens demonstrated hysteresis and its relation with histological features.[14,15] The role of the viscosity component of the arterial wall on pulse wave damping has been well demonstrated.[16-18] Arterial pressure-diameter loops have been obtained noninvasively, using tonometry and B-mode ultrasound examination, on common carotid arteries to provide a wall viscosity index which was found greater in hypertensive than in normotensive patients.[19,20] On the radial artery of healthy volunteers, this approach allowed Roca et al to demonstrate the involvement of endothelial factors in the control of arterial wall viscosity.[21] The role of viscosity has been also been studied in animals[22] and in human saphenous vein bypass grafts.[23-25] Using strain-gauge plethysmography during lower limb venous occlusion in patients with varicose veins and in normal patients, Pointel et al[3] obtained typical hysteresis curves, showing greater distensibility in patients with CVD. The same technique has been used by Journo et al[26] to assess the forearm venous pressure-volume relationship in young patients with borderline hypertension and normal controls. They obtained typical hysteresis curve of which the area was smaller in hypertensive than in controls patients, suggesting that the viscous component of the venous wall was altered.[26]

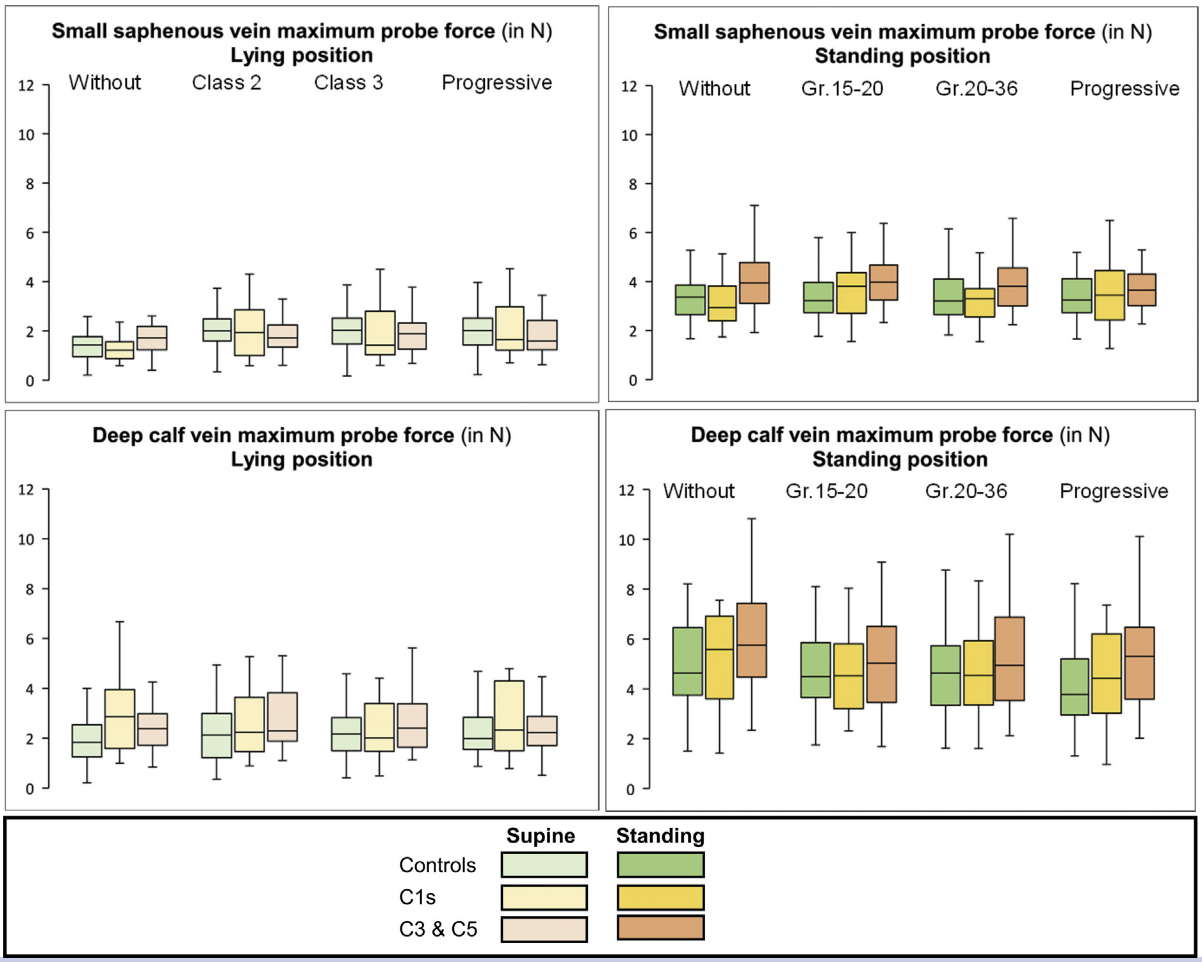
Lower IFP in C_{1s} limbs. Greater stiffness of skin and subcutaneous tissues in C_3 and C_5 limbs could result in higher IFP when measured by Kikuhime sensors (because of their small but not negligible thickness), but this would not explain the difference between C_{1s} limbs and controls. We hypothesized that greater subcutaneous tissue stiffness would be reflected by smaller relative changes in the depth of the vein (ultrasound probe to vein distance) during compression by the ultrasound probe, but there was no significant difference between groups in this regard. Similarly, the loss of the normal curvaceous shape of the calf in C_3 (because of edema) and in C_5 limbs (because of skin and soft tissue changes) would result in a more cylindrical shape, thus reducing the differences in IFP between the medial and lateral sensors. We did find smaller medial versus lateral IFP differences in C_{1s} limbs than in controls at the B level in both positions. There were also smaller differences in controls than in C_3 and C_5 limbs at the B1 level in the standing position, but these differences were in a much narrower range. However, these differences were not significantly smaller in C_{1s} than in C_3 and C_5 limbs at any level and in either position. We speculate that a lower skeletal muscle tonus, at the calf, could have contributed to lower differences in medial/lateral IFP in C_{1s} than in control limbs, whereas the loss of the normal shape of the calf could explain the same finding in C_3 and C_5 limbs because of edema and soft tissue changes. Andreozzi et al. introduced the hypothesis of "hypotonic phlebopathy" in C0s CEAP category limbs.[27] However, we cannot offer definitive data in this regard, and this will have to be further investigated.



Supplementary Fig 1 (online only). Mean intravenous and intramuscular pressure (mm Hg) in normal controls and in limbs with chronic venous disease (CVD) without, with graduated 15 to 20 mm Hg and 20 to 36 mm Hg, and with progressive elastic compression stockings (ECS). Differences between ECS (Dunn's multiple comparison test post Friedman analysis of variance) are shown as horizontal brackets when significant.



Supplementary Fig 2 (online only). Cross-sectional area of the small saphenous vein (*SSV*) and of the deep calf vein (*DCV*) at rest in the supine and in the standing position without and with elastic compression stockings (ECS). Box-and-whiskers plot of cross-sectional area, in square millimeters, of the SSV and of the DCV at rest in the supine (*AL*) and in the standing (*AS*) position without, with graduated 15 to 20 mm Hg and 20 to 36 mm Hg, and with progressive ECS. Difference between the supine and the standing position (Wilcoxon signed rank test) is reported as *P* value under the boxes. Differences between compression stockings (Dunn's multiple comparison test post Friedman analysis of variance) are shown as horizontal brackets when significant.



Supplementary Fig 3 (online only). Maximum probe force during the compression test of the small saphenous vein (SSV) and of the deep calf vein (DCV). Box-and-whiskers plots of the maximum force (in N) applied by the operator on the ultrasound probe to collapse the SSV and the DCV in normal controls, in limbs with C_{1s}, and in limbs with C_3 or C_5 CEAP category of chronic venous disease (CVD), without, with graduated 15 to 20 mm Hg and 20 to 36 mm Hg, and with progressive compression stockings.

Supplementary Table I (online only). Lower limb mean intravenous pressure (IVPm)

IVPm	Without ECS	Graduated 15-20 ECS	Graduated 20-36 ECS	Progressive ECV	Friedman test *P*	Without vs graduated 15-20 ECS	Without vs graduated 20-36 ECS	Without vs progressive ECS	Graduated 15-20 vs graduated 20-36 ECS	Graduated 15-20 mm Hg vs progressive ECS	Graduated 25-36 mm Hg vs progressive ECS
All participants (n = 30)											
Supine	11.6 [6.3-16.7]	17.4 [12.7-22.3]	18.5 [14.3-21.1]	19.7 [12.9-25.3]	***Fp* = .0056**		***Dp* < .05**	***Dp* < .05**			
Standing	54.2 [11.2-60.0]	54.2 [21.9-62.8]	55.7 [25.4-63.1]	56.1 [31.3-61.2]	***Fp* = .0027**			***P* < .01**			
Wilcoxon	***Wp* < .0001**	***Wp* < .0001**	***Wp* < .0001**	***Wp* < .0001**							
Controls (n = 15)											
Supine	10.6 [4.9-15.3]	15.4 [12.6-19.9]	18.7 [17.1-21.6]	20.0 [11.1-26.2]	*Fp* = .06						
Standing	48.6 [-3.0-59.2]	45.5 [12.1-61.9]	52.5 [14.3-61.3]	53.9 [15.3-60.5]	***Fp* = .042**			***Dp* < .05**			
Wilcoxon	***Wp* = .030**	***Wp* = .017**	***Wp* = .026**	***Wp* = .022**							
Patients with CVD (n = 15)											
Supine	14.3 [8.3-22.0]	19.7 [13.9-24.0]	16.9 [13.61-20.0]	19.4 [14.7-25.3]	*Fp* = .09						
Standing	58.0 [51.0-65.0]	54.6 [51.2-64.4]	56.6 [53.0-66.4]	57.3 [51.4-61.9]	*Fp* = .09						
Wilcoxon	***Wp* = .0001**	***Wp* = .0001**	***Wp* = .0001**	***Wp* = .0001**							
MW supine	*MWp* = .09	*MWp* = .20	*MWp* = .56	*MWp* = .90							
MW standing	***MWp* = .011**	*MWp* = .11	*MWp* = .20	*MWp* = .19							

Dp, P value of Dunn's multiple comparison between ECS classes; *Fp, P* value of comparison between elastic compression stockings (ECS) in analysis of variance in Friedman test; *MWp, P* value of comparison between normal controls and limbs with chronic venous disease in Man-Whitney test; *Wp, P* value of comparison between the supine and the standing position in Wilcoxon signed rank test.
Lower limb mean intravenous (IVPm) pressure (in mm Hg) in the supine and in the standing positions in the whole population sample (n = 30), in normal controls (n = 15), and in limbs with chronic venous disease (CVD) without or with graduated 15-20 mm Hg, graduated 20-36 mm Hg, and progressive elastic compression stockings (ECS). Values are provided as median [1st-3rd quartile]. Boldface entries indicate statistical significance.

Supplementary Table II (online only). Lower limb lower intravenous pressure (IVPm) in the standing position at the end of the tiptoe test movements

IVPmin	Without ECS	Graduated 15-20 ECS	Graduated 20-36 ECS	Progressive ECS	Friedman test *P*	Without vs graduated 15-20 ECS	Without vs graduated 20-36 ECS	Without vs progressive ECS	Graduated 15-20 vs graduated 20-36 ECS	Graduated 15-20 vs progressive ECS	Graduated 20-36 vs progressive
All	27.7 [18.1-46.0]	32.7 [19.0-45.1]	37.1 [28.4-46.4]	33.5 [23.6-46.5]	***Fp* < .0001**		***Dp* < .001**	***Dp* < .01**	***Dp* < .01**		
Controls	21.3 [-6.0-34.2]	24.4 [11.3-40.1]	29.9 [16.8-43.4]	29.4 [12.1-35.7]	***Fp* = .0066**		***Dp* < .05**	***Dp* < .05**			
CVD	36.7 [26.4-56.0]	41.2 [27.0-56.8]	44.1 [35.3-62.1]	44.5 [29.2-62.1]	***Fp* = .0071**				***Dp* < .05**		
Controls vs CVD	***MWp* = .011**	***MWp* = .028**	***P* = .011**	***P* = .016**							

CVD, Chronic venous disease; *Dp, P* value comparison between ECSs if Friedman test yielded *P* < .05; *ECS,* elastic compression stockings; *Fp, P* value of comparison between ECSs in Friedman test; *MWp, P* value of comparison between normal controls and patients with CVD in Mann-Whitney test.
Lower limb IVPm in the standing position at the end of the tiptoe test movements (IVPmin, in mm Hg), before venous refilling, in all patients (n = 28), in normal controls (n = 14), and in patients with CVD (n = 14) without, with graduated 15-20 mm Hg, graduated 20-36 mm Hg, and with progressive ECS. Values are provided as median [lower-upper quartile]. Boldface entries indicate statistical significance.

Supplementary Table III (online only). Lower limb mean intramuscular pressure (*IMPm*)

IMPm	Without ECS	Graduated 15-20 ECS	Graduated 20-36 ECS	Progressive ECS	Friedman test *P*	Without vs graduated 15-20 ECS	Without vs graduated 20-36 ECS	Without vs progressive ECS	Graduated 15-20 vs graduated 20-36 ECS	Graduated 15-20 vs progressive ECS	Graduated 20-36 vs progressive
All participants (n = 34)											
Supine	2.5 [-1.0 to 4.7]	13.1 [9.8 to 17.3]	18.2 [13.2 to 22.6]	20.7 [16.7 to 28.2]	***Fp < .0001***	***Dp < .01***	***Dp < .001***	***Dp < .001***	***Dp < .01***	***Dp < .001***	
Standing	−8.6 [−17.3 to −6.5]	3.2 [−0.5 to 11.0]	8.2 [1.8 to 15.5]	13.5 [0.9 to 20.8]	***Fp < .0001***	***Dp < .001***	***Dp < .001***	***Dp < .001***		***Dp < .01***	
Wilcoxon	***Wp < .0001***	***Wp < .0001***	***Wp < .0001***	***Wp < .0001***							
Normal controls (n = 17)											
Supine	1.5 [−2.7 to 4.1]	12.6 [8.4 to 15.9]	18.0 [12.9 to 22.6]	20.3 [16.9 to 28.4]	***Fp < .0001***		***Dp < .001***	***Dp < .001***	***Dp < .05***	***Dp < .01***	
Standing	−16.8 [−20.1 to −8.4]	1.4 [−2.0 to 9.6]	6.8 [0.8 to 16.7]	13.0 [−1.2 to 14.7]	***Fp < .0001***	***Dp < .01***	***Dp < .001***	***Dp < .001***			
Wilcoxon	***Wp = .0003***	***Wp = .0011***	***Wp = .0044***	***Wp = .0004***							
Patients with CVD (n = 17)											
Supine	2.7 [−0.1 to 7.7]	15.2 [10.4 to 18.4]	18.3 [13.7 to 22.4]	21.8 [15.9 to 28.2]	***Fp < .0001***	***Dp < .05***	***Dp < .001***	***Dp < .001***		***Dp < .05***	
Standing	−7.3 [−11.0 to −2.4]	7.2 [0.6 to 11.8]	9.5 [3.1 to 15.5]	14.7 [5.2 to 25.3]	***Fp < .0001***	***Dp < .05***	***Dp < .001***	***Dp < .001***		***Dp < .05***	
Wilcoxon	***Wp = .006***	***Wp = .006***	***Wp = .006***	***Wp = .015***							
MW supine	*MWp = .52*	*MWp = .26*	*MWp = .84*	*MWp = .97*							
MW standing	***MWp = .007***	*MWp = .18*	*MWp = .86*	***MWp = .04***							

Dp, P value of Dunn's multiple comparison between ECSs; *Fp, P* value of comparison between elastic compression stockings (ECS) in an analysis of variance in Friedman test; *MWp, P* value of comparison between normal controls and limbs with chronic venous disease in Mann-Whitney test; *Wp, P* value of comparison between the supine and the standing position in Wilcoxon signed rank test.
Lower limb IMPm pressure (in mm Hg) in the supine and in the standing position in the whole population sample (n = 30), in normal controls (n = 15), and *in* limbs with chronic venous disease (*CVD*) without or with graduated 15-20 mm Hg, graduated 20-36 mm Hg, or progressive elastic compression stockings (*ECS*). Values are provided as median [1st-3rd quartile]. Boldface entries indicate statistical significance.

Supplementary Table IV (online only). Intraobserver reproducibility of interface pressure (IFP) readings

	Without ECS	With Graduated 15-20 mm Hg ECS	With Graduated 20-36 mm Hg ECS	With Progressive ECS
Lying position				
ρ_c	0.9999	0.9978	0.9996	0.9962
Lower 95% CL	0.9999	0.9973	0.9995	0.9951
Upper 95% CL	0.9999	0.9983	0.9997	0.997
Standing position				
ρ_c	0.9994	0.9987	0.9992	0.9996
Lower 95% CL	0.9993	0.9984	0.999	0.9996
Upper 95% CL	0.9995	0.9989	0.9994	0.9997

Intraobserver reproducibility of IFP readings: Lin concordance correlation coefficient (*ρc*) calculated on a randomly selected sample of 30 patients, with lower and upper 95% 2-sided confidence limits (*CL*) without, with graduated 15-20 mm Hg, graduated 20-36 mm Hg, and progressive elastic compression stockings (*ECS*).

Supplementary Table V. Interface pressures (IFP) at the nine reference leg levels in limbs with chronic venous disease (CVD) and in controls

	Controls	C_{1s}	C_3 and C_5	Kruskal-Wallis	Controls vs C_{1s}	Controls vs C_3 and C_5	C_{1s} vs C_3 and C_5
B							
Graduated 15-20 ECS	***Wp = .0002***	***Wp = .031***	***Wp < .0001***				
Supine	20.40 [17.24-24.83]	11.51 [7.34-13.82]	19.85 [12.77-24.58]	***Kp < .0001***	***Dp < .001***		***Dp < .01***
Standing	22.20 [19.33-26.04]	12.51 [6.77-16.54]	22.19 [13.84-28.29]	***Kp < .0001***	***Dp < .001***		***Dp < .001***
Graduated 20-36 ECS	***Wp < .0001***	***Wp = .021***	***Wp = .0001***				
Supine	25.42 [21.25-28.92]	14.04 [6.97-16.37]	24.15 [16.95-28.17]	***Kp < .0001***	***Dp < .001***		***Dp < .001***
Standing	29.08 [22.37-31.93]	14.96 [9.74-18.19]	28.51 [18.24-31.05]	***Kp < .0001***	***Dp < .001***		***Dp < .01***
Progressive ECS	***Wp < .0001***	***Wp = .0002***	***Wp < .0001***				
Supine	13.74 [11.68-15.48]	7.58 [3.18-8.99]	11.96 [8.75-16.70]	***Kp < .0001***	***Dp < .001***		***Dp < .01***
Standing	15.09 [12.44-17.40]	8.26 [5.05-10.70]	14.33 [9.06-19.49]	***Kp < .0001***	***Dp < .001***		***Dp < .01***
B1m							
Graduated 15-20 ECS	***Wp < .0001***	***Wp = .002***	***Wp < .0001***				
Supine	27.06 [23.18-29.47]	13.46 [5.98-23.75]	23.83 [16.10-27.11]	***Kp < .0001***	***Dp < .001***	***Dp < .05***	
Standing	32.87 [29.88-36.26]	16.45 [7.39-25.46]	27.46 [20.77-31.83]	***Kp < .0001***	***Dp < .001***	***Dp < .001***	
Graduated 20-36 ECS	***Wp < .0001***	***Wp = .0004***	***Wp < .0001***				
Supine	32.10 [27.70-36.63]	16.00 [6.62-28.17]	26.76 [15.22-32.30]	***Kp < .0001***	***Dp < .001***	***Dp < .01***	
Standing	39.77 [33.78-42.50]	20.84 [13.23-31.78]	30.23 [19.18-39.51]	***Kp < .0001***	***Dp < .01***		
Progressive ECS	***Wp < .0001***	***Wp = .034***	***Wp < .0001***				
Supine	20.58 [18.40-23.32]	9.71 [4.47-17.91]	18.34 [12.29-21.90]	***Kp < .0001***	***Dp < .001***	***Dp < .05***	***Dp < .05***
Standing	24.73 [21.96-28.23]	11.90 [9.59-20.65]	22.37 [13.51-25.32]	***Kp < .0001***	***Dp < .001***	***Dp < .05***	***Dp < .05***
B1							
Graduated 15-20 ECS	*Wp < .0001*	*Wp = .009*	*Wp < .0001*				
Supine	20.08 [17.80-22.28]	11.05 [6.42-16.34]	18.02 [11.79-21.37]	***Kp < .0001***	***Dp < .001***	***Dp < .05***	***Dp < .05***
Standing	25.08 [22.23-27.71]	11.75 [5.82-20.47]	21.21 [14.39-24.02]	***Kp < .0001***	***Dp < .001***	***Dp < .001***	***Dp < .05***
Graduated 20-36 ECS	***Wp < .0001***	***Wp = .0006***	***Wp < .0001***				
Supine	23.65 [21.43-25.45]	10.46 [5.81-19.46]	19.38 [12.12-23.05]	***Kp < .0001***	***Dp < .001***	***Dp < .001***	
Standing	28.86 [26.36-31.71]	12.70 [6.31-24.50]	23.12 [14.28-26.67]	***Kp < .0001***	***Dp < .001***	***Dp < .001***	
Progressive ECS	***Wp < .0001***	***Wp = .0026***	***Wp < .0001***				
Supine	22.08 [19.85-25.44]	10.34 [5.43-17.26]	18.99 [11.16-21.25]	***Kp < .0001***	***Dp < .001***	***Dp < .01***	***Dp < .05***
Standing	26.26 [23.50-30.57]	12.00 [9.16-20.40]	21.83 [14.86-25.13]	***Kp < .0001***	***Dp < .001***	***Dp < .001***	***Dp < .05***
C							
Graduated 15-20 ECS	***Wp < .0001***	***Wp = .0018***	***Wp = .0006***				
Supine	18.78 [16.89-20.55]	9.73 [8.11-14.73]	17.41 [10.90-18.99]	***Kp < .0001***	***Dp < .001***		***Dp < .01***
Standing	21.59 [20.21-24.21]	11.42 [8.88-17.28]	19.72 [13.87-21.99]	***Kp < .0001***	***Dp < .001***	***Dp < .01***	***Dp < .01***
Graduated 20-36 ECS	***Wp < .0001***	***Wp = .0006***	***Wp < .0001***				
Supine	23.18 [21.73-24.13]	11.09 [8.29-18.58]	19.99 [12.03-22.49]	***Kp < .0001***	***Dp < .001***	***Dp < .001***	
Standing	26.78 [25.03-28.90]	13.09 [10.10-21.79]	22.99 [14.94-25.53]	***Kp < .0001***	***Dp < .001***	***Dp < .001***	

(Continued on next page)

Supplementary Table V. Continued.

	Controls	C_{1s}	C_3 and C_5	Kruskal-Wallis	Controls vs C_{1s}	Controls vs C_3 and C_5	C_{1s} vs C_3 and C_5
Progressive ECS	***Wp < .0001***	***Wp = .0016***	***Wp < .0001***				
Supine	29.15 [26.87-31.24]	14.11 [10.53-25.99]	26.35 [15.13-29.36]	***Kp < .0001***	***Dp < .001***	***Dp < .01***	***Dp < .05***
Standing	33.70 [31.84-36.52]	16.14 [13.12-29.82]	30.37 [17.89-34.23]	***Kp < .0001***	***Dp < .001***	***Dp < .01***	
D							
Graduated 15-20 ECS	*Wp < .0001*	*Wp = .09*	*Wp = .0009*				
Supine	18.11 [16.20-20.23]	11.44 [6.13-15.45]	16.97 [10.61-20.90]	***Kp = .0001***	***Dp < .001***		***Dp < .05***
Standing	20.29 [18.00-22.14]	12.65 [6.24-16.38]	19.41 [11.91-21.73]	***Kp < .0001***	***Dp < .001***		***Dp < .01***
Graduated 20-36 ECS	***Wp < .0001***	*Wp = .075*	***Wp = .0001***				
Supine	21.12 [19.60-23.27]	12.21 [6.94-16.97]	18.77 [12.54-22.52]	***Kp < .0001***	***Dp < .001***	***Dp < .01***	***Dp < .05***
Standing	22.92 [20.54-24.68]	13.44 [11.22-18.00]	20.59 [13.77-24.79]	***Kp < .0001***	***Dp < .001***		***Dp < .05***
Progressive ECS	*Wp = .39*	*Wp = .69*	*Wp = .07*				
Supine	21.27 [18.01-25.64]	12.69 [5.02-17.22]	19.28 [13.77-23.43]	***Kp < .0001***	***Dp < .001***		***Dp < .05***
Standing	21.42 [17.59-27.05]	12.55 [9.56-16.94]	19.00 [14.15-24.79]	***Kp < .0001***	***Dp < .001***		***Dp < .05***
Averaged value of All 9 Sensors				***IFP difference of medians (mm Hg)***			
Graduated 15-20 ECS				***Controls - C_{1s}***		***C_3* and *5 - C_{1s}***	
Supine	20.55 [18.76-22.38]	11.28 [6.61-16.52]	19.72 [11.98-21.55]	-9.27		-8.44	
Standing	23.72 [22.55-25.76]	13.03 [6.64-19.26]	22.27 [13.78-24.59]	-10.69		-9.24	
Graduated 20-36 ECS							
Supine	24.49 [22.84-26.03]	12.71 [7.58-19.98]	21.63 [13.01-24.14]	-11.78		-8.92	
Standing	28.25 [27.07-29.84]	14.59 [10.83-23.98]	25.67 [15.78-27.34]	-13.66		-11.08	
Progressive ECS							
Supine	21.60 [20.61-23.10]	10.71 [5.54-18.72]	20.01 [12.13-22.01]	-10.89		-9.03	
Standing	28.25 [27.07-29.84]	14.59 [10.83-23.98]	25.67 [15.78-27.34]	-12.33		-10.64	

Dp, P value of differences between controls, C_{1s}, and C_3 and C_5 limbs in Dunn's multiple comparison; *Kp, P* value of analysis of variance between controls, C_{1s}, and C_3 and C_5 patients in Kruskal-Wallis test; *Wp, P* value of comparison between the supine and the standing positions in Wilcoxon signed rank test.

Interface pressures (IFP; in mm Hg) at the B, B1i, B1, C, and D reference leg levels in normal controls, in limbs with C_{1s}, and in limbs with C_3 or C_5 CEAP category of chronic venous disease, without, with graduated 15 to 20 mm Hg, graduated 20-36 mm Hg, and progressive elastic compression stocking (ECS) in the supine and in the standing position. Values are provided as median [1st-3rd quartile]. IFP values from the lateral and medial sensors were averaged at the B, B1, C, and D levels. Boldface entries indicate statistical significance.

Supplementary Table VI (online only). Differences in the interface pressure (IFP) between the nine reference leg levels

	Lying			Standing		
	Graduated 15-20 ECS	Graduated 20-36 ECS	Progressive ECS	Graduated 15-20 ECS	Graduated 20-36 ECS	Progressive ECS
Controls						
Friedman test	$P < .0001$	$P < .0001$	$P < .0001$	$P < .0001$	$P < .0001$	$P < .0001$
Dunn's						
B vs B1i	$P < .001$	$P < .001$	$P < .001$	$P < .001$	$P < .001$	$P < .001$
B vs B1			$P < .001$			$P < .001$
B vs C	$P < .05$		$P < .001$			$P < .001$
B vs D	$P < .001$	$P < .001$	$P < .001$	$P < .01$	$P < .001$	$P < .001$
B1i vs B1	$P < .001$	$P < .001$		$P < .001$	$P < .001$	
B1i vs C	$P < .001$	$P < .001$	$P < .001$	$P < .001$	$P < .001$	$P < .001$
B1i vs D	$P < .001$	$P < .001$		$P < .001$	$P < .001$	
B1 vs C			$P < .001$	$P < .01$		$P < .001$
B1 vs D	$P < .01$	$P < .01$		$P < .001$	$P < .001$	
C vs D			$P < .001$		$P < .01$	$P < .001$
C_{1s} patients						
Friedman	**$P = .004$**	**$P = .002$**	**$P < .0001$**	**$P = .001$**	**$P < .0001$**	**$P < .0001$**
Dunn's						
B vs B1i						
B vs B1						
B vs C			$P < .001$			$P < .001$
B vs D			$P < .01$		$P < .05$	
B1i vs B1	$P < .05$	$P < .01$			$P < .01$	
B1i vs C	$P < .01$		$P < .001$	$P < .01$	$P < .05$	$P < .001$
B1i vs D		$P < .01$		$P < .01$	$P < .001$	
B1 vs C			$P < .001$			$P < .01$
B1 vs D						
C vs D			$P < .05$			$P < .001$
C_3 and C_5 patients						
Friedman	**$P < .0001$**	**$P < .0001$**	**$P < .0001$**	**$P < .0001$**	**$P < .0001$**	**$P < .0001$**
Dunn's						
B vs B1i			$P < .05$			$P < .01$
B vs B1	$P < .05$	$P < .001$	$P < .05$			$P < .05$
B vs C	$P < .01$	$P < .05$	$P < .001$	$P < .05$	$P < .05$	$P < .001$
B vs D	$P < .01$	$P < .001$	$P < .001$	$P < .01$	$P < .001$	$P < .01$
B1i vs B1	$P < .001$	$P < .001$		$P < .01$	$P < .001$	
B1i vs C	$P < .001$	$P < .01$	$P < .001$	$P < .001$	$P < .001$	$P < .001$
B1i vs D	$P < .001$	$P < .001$		$P < .001$	$P < .001$	
B1 vs C			$P < .001$			$P < .001$
B1 vs D						
C vs D			$P < .01$			$P < .001$

P value of differences in Interface pressure (IFP) between the B, B1i, B1, C, and D reference levels in normal controls, in limbs with C_{1s}, and in limbs with C_3 or C_5 CEAP category of chronic venous disease, with graduated 15-20 mm Hg, graduated 20-36 mm Hg, and progressive elastic compression stockings (*ECS*) in the supine and in the standing position. IFP values provided by the lateral and medial sensors were averaged at the B, B1, C, and D levels. Friedman: *P* value of differences between ECS classes, in Friedman test, followed, if $P < .05$, by Dunn's multiple comparison for all pairs of data. Boldface entries indicate statistical significance.

Supplementary Table VII (online only). Differences in Interface pressure (IFP) between elastic compression stockings (*ECS*)

	B	B1m	B1	C	D
Supine position					
Friedman test	***P* < .0001**	***P* < .0001**	***P* < .0001**	***P* < .0001**	***P* < .0001**
Dunn's multiple comparison					
Graduated 15-20 vs 20-36 mm Hg	***P* < .001**	*P* < .01	***P* < .001**	***P* < .001**	***P* < .001**
Graduated 15-20 mm Hg vs progressive progressive	***P* < .001**	***P* < .001**	NS	***P* < .001**	***P* < .001**
Graduated 20-36 mm Hg vs progressive progressive	***P* < .001**	***P* < .001**	NS	***P* < .001**	NS
Standing position					
Friedman test	***P* < .0001**	***P* < .0001**	***P* < .0001**	***P* < .0001**	***P* < .0001**
Dunn's multiple comparison					
Graduated 15-20 vs 20-36 mm Hg	***P* < .001**	*P* < .01	***P* < .001**	***P* < .001**	*P* < .01
Graduated 15-20 mm Hg vs progressive progressive	***P* < .001**	***P* < .001**	NS	***P* < .001**	NS
Graduated 20-36 mm Hg vs progressive progressive	***P* < .001**	***P* < .001**	*P* < .01	***P* < .001**	NS

NS, Not significant.
P value of differences in IFP between the B, B1m, B1, C, and D reference levels in normal controls, in limbs with C_{1s}, and in limbs with C_3 or C_5 CEAP category of chronic venous disease, with graduated 15-20 mm Hg and 20-36 mm Hg, and with progressive ECS in the supine and in the standing position. Values provided by the lateral and medial sensors were averaged at the B, B1, C, and D levels. Friedman test: *P* value of differences between ECS categories, in Friedman test, followed, if *P* < .05, by Dunn's multiple comparison for all pairs of data. Boldface entries indicate statistical significance.

Supplementary Table VIII (online only). Relative change in interface pressure (IFP) from the supine to the standing position

Leg level	Controls	*P* value	C_{1s}	*P* value	C_3 and C_5	*P* value
With graduated 15-20 mm Hg ECS						
B	5 [−1 to 13]	***P* = .0002**	7 [−7 to 16]	***P* = .03**	9 [2 to 14]	***P* ≤ .0001**
B1i	16 [11 to 26]	***P* < .0001**	22 [4 to 28]	***P* = .002**	12 [6 to 18]	***P* ≤ .0001**
B1	20 [12 to 25]	***P* < .0001**	17 [11 to 23]	***P* = .01**	14 [7 to 21]	***P* ≤ .0001**
C	15 [10 to 21]	***P* < .0001**	12 [2 to 17]	***P* = .002**	12 [1 to 19]	***P* = .0006**
D	9 [3 to 13]	***P* < .0001**	7 [2 to 16]	***P* = .09**	9 [1 to 16]	***P* = .0009**
With graduated 20-36 mm Hg ECS						
B	9 [3 to 17]	***P* < .0001**	8 [−4 to 15]	***P* = .02**	10 [−1 to 17]	***P* = .0001**
B1i	16 [10 to 23]	***P* < .0001**	18 [15 to 25]	***P* = .0004**	13 [8 to 21]	***P* ≤ .0001**
B1	18 [13 to 21]	***P* < .0001**	16 [10 to 21]	***P* = .0006**	14 [8 to 20]	***P* ≤ .0001**
C	14 [9 to 18]	***P* < .0001**	12 [3 to 18]	***P* = .0006**	13 [3 to 18]	***P* ≤ .0001**
D	5 [2 to 10]	***P* < .0001**	8 [−1 to 15]	***P* = .07**	8 [4t o 14]	***P* = .0001**
With progressive ECS						
B	9 [1 to 17]	***P* < .0001**	12 [7 to 21]	***P* = .0002**	12 [1 to 21]	***P* ≤ .0001**
B1i	14 [8 to 22]	***P* < .0001**	20 [0 to 29]	***P* = .03**	14 [6 to 28]	***P* ≤ .0001**
B1	17 [12 to 22]	***P* < .0001**	12 [1 to 17]	***P* = .003**	14 [8 to 19]	***P* ≤ .0001**
C	13 [8 to 19]	***P* < .0001**	9 [2 to 17]	***P* = .002**	9 [6 to 18]	***P* ≤ .0001**
D	1 [−6 to 8]	***P* = .39**	2 [−2 to 6]	***P* = .69**	4 [−2 to 10]	*P* = .07

Relative change (%) in IFP from the supine to the standing position [100(IFP standing−IFP supine)/IFP standing], and differences in IFP values between the supine and the standing position, in normal controls, in limbs with C_{1s}, and in limbs with C_3 or C_5 CEAP category of chronic venous disease at the B, B1i, B1, C, and D leg levels. Values are provided as median [1st-3rd quartile]. IFP values from the lateral and medial sensors were averaged at the B, B1, C, and D levels. Boldface entries indicate statistical significance. *ECS,* Elastic compression stockings; *P, P* value of differences in IFP values between the supine and the standing position in Wilcoxon-Mann-Whitney matched pairs test.

Supplementary Table IX (online only). Difference in interface pressure (IFP) between the medial and the lateral sensors

	Controls	C_{1s} limb	C_3 and C_5 limbs	Kruskal -Wallis	Controls vs C_{1s}	Controls vs C_3 and C_5	C_{1s} vs C_3 and C_5
B level							
Graduated 15-20 mm Hg ECS							
Supine	16.99 [11.94 to 23.31]	8.08 [−4.82 to 11.13]	12 [5.545 to 18.29]	**Kp < .0001**	**Dp < .001**	**Dp < .05**	
Standing	14.23 [6.515 to 20.18]	5.95 [−7.375 to 9.165]	9.44 [3.47 to 15.55]	**Kp = .0004**	**Dp < .001**		
Graduated 20-36 mm Hg ECS							
Supine	17.48 [12.05 to 23.59]	8.01 [−4.89 to 14.87]	16.97 [5.945 to 20.29]	**Kp = .002**	**Dp < .01**		
Standing	11.79 [6.86 to 20.35]	6.5 [−4.77 to 12.38]	13.09 [3.35 to 19.76]	**Kp = .03**	**Dp < .05**		
Progressive ECS							
Supine	11.19 [6.4 to 16.52]	5.08 [−2.74 to 6.75]	6.55 [1.79 to 11.03]	**Kp < .0001**	**Dp < .001**	**Dp < .01**	
Standing	8.00 [3.16 to 12.29]	1.69 [−1.12 to 4.57]	5.65 [0.74 to 9.20]	**Kp = .0002**	**Dp < .001**		
B1 level							
Graduated 15-20 mm Hg ECS							
Supine	−0.47 [−2.39 to 1.225]	−0.30 [−1.17 to 0.9]	0.88 [−0.84 to 2.365]	**Kp = .025**		**Dp < .05**	
Standing	−4.88 [−7.13 to −1.93]	0.66 [−1.73 to 0.33]	−0.68 [−3.15 to 2.08]	**Kp < .0001**	**Dp < .001**	**Dp < .001**	
Graduated 20-36 mm Hg ECS							
Supine	−0.75 [−2.015 to 1.585]	−0.36 [−2.17 to 0.7]	0.01 [−1.53 to 2.195]	Kp = .35			
Standing	−4.33 [−6.98 to −1.81]	−1.17 [−3.74 to −0.22]	−1.67 [−3.32 to 0.63]	**Kp = .0005**	**Dp < .05**	**Dp < .001**	
Progressive ECS							
Supine	−1.24 [−2.875 to 1.005]	−0.70 [−2.19 to 0.2]	1.12 [−1.1 to 2.60]	**Kp = .017**		**Dp < .05**	
Standing	−4.11 [−7.85 to −2.09]	−0.84 [−3.52 to 0.05]	−1.27 [−3.28 to 1.07]	**Kp < .0001**	**Dp < .05**	**Dp < .001**	
C level							
Graduated 15-20 mm Hg ECS							
Supine	1.92 [0.08 to 3.96]	0.62 [0.15 to 3.505]	1.78 [0.3 to 3.1]	*P* = .66			
Standing	−0.65 [−2.81 to 2.64]	0.85 [−0.7 to 3.56]	1.49 [−0.50 to 4.99]	***P* = .031**		***P* < .05**	
Graduated 20-36 mm Hg ECS							
Supine	0.89 [−1.17 to 4.15]	0.99 [0.27 to 4.17]	1.51 [0.15 to 2.525]	*P* = .78			
Standing	−2.06 [−4.52 to 1.89]	0.65 [−0.89 to 4.03]	0.65 [−0.90 to 3.25]	***P* = .003**	***P* < .05**	***P* < .05**	
Progressive ECS							
Supine	3.41 [0.74 to 5.40]	2.06 [−0.08 to 4.39]	1.89 [0.05 to 3.49]	*P* = .12			
Standing	1.09 [−1.96 to 3.77]	0.82 [−0.85 to 4.60]	1.67 [−0.10 to 3.25]	*P* = .92			
D level							
Graduated 15-20 mm Hg ECS							
Supine	2.28 [−0.1 to 3.97]	1.00 [−1.19 to 3.22]	1.19 [−0.61 to 2.79]	*P* = .15			
Standing	3.59 [1.35 to 6.88]	1.90 [−0.73 to 3.50]	1.93 [0.56 to 3.67]	***P* = .006**	***P* < .05**	***P* < .05**	
Graduated 20-36 mm Hg ECS							
Supine	1.94 [−0.225 to 3.675]	0.56 [−1.655 to 2.73]	0.99 [−0.62 to 2.51]	*P* = .13			
Standing	3.58 [0.75 to 6.46]	0.00 [−1.19 to 2.19]	1.06 [−1.08 to 3.14]	***P* = .0014**	***P* < .01**	***P* < .05**	
Progressive ECS							
Supine	−0.09 [−2.64 to 3.01]	−0.3 [−1.37 to 1.87]	0.44 [−1.15 to 2.93]	*P* = .75			
Standing	1.86 [−1.28 to 5.25]	−0.32 [−1.59 to 1.90]	1.00 [−1.34 to 4.38]	*P* = .27			

ECS, Elastic compression stockings; *P*, *P* value of comparison between groups in Kruskal-Wallis test, followed, if $P < .05$, by Dunn's multiple comparison.

Difference in IFP between the medial and the lateral sensors at the B, B1, C, and D leg levels in the supine and in the standing position in normal controls, in C_{1s} limbs, and C_3 and C_5 limbs. Values are provided as median [lower-upper quartile]. Boldface entries indicate statistical significance.

Supplementary Table X (online only). Small saphenous and deep calf vein (DCV) cross-sectional area (mm^2) in patients with CVD and controls without and with elastic compression stockings (*ECS*)

SSV	Controls	C_{1s}	C_3 and C_5	KWp	Controls vs C_{1s}	Controls vs C_3 and C_5	C_{1s} vs C_3 and C_5
Supine (SSV AL)							
Without ECS	2.94 [1.76-5.18]	3.95 [2.33-4.97]	4.87 [3.57-7.06]	***KWp = .0075***		***Dp < .01***	
Graduated15-20 ECS	1.93 [1.18-4.54]	3.38 [1.82-4.79]	5.18 [3.32-8.34]	***KWp = .001***		***Dp < .001***	
Graduated 20-36 ECS	2.39 [1.53-3.63]	2.68 [1.91-4.33]	4.18 [3.02-8.85]	***KWp < .0001***		***Dp < .001***	
Progressive ECS	1.45 [0.61-3.08]	2.59 [1.41-4.34]	3.47 [0.84-5.99]	***KWp = .0016***		***Dp < .01***	
Standing (SSV AS)							
Without ECS	3.75 [2.12-5.41]	4.70 [2.56-6.16]	7.07 [2.96-9.90]	***KWp = .0023***		***Dp < .01***	
Graduated15-20 ECS	3.30 [2.14-6.07]	4.27 [2.93-9.28]	6.72 [3.39-11.60]	***KWp < .0001***	***P < .05***	***Dp < .001***	
Graduated 20-36 ECS	3.59 [1.89-5.38]	4.29 [3.29-6.22]	6.69 [3.68-9.99]	***KWp < .0001***		***Dp < .001***	
Progressive ECS	3.11 [1.69-4.71]	3.43 [2.65-5.95]	6.14 [2.48-11.93]	***KWp = .0007***		***Dp < .001***	
DCV	Controls	C_{1s}	C_3 and C_5	KWp	Controls vs C_{1s}	Controls vs C_3 and C_5	C_{1s} vs C_3 and C_5
Supine (DV AL)							
Without ECS	8.69 [5.70-14.28]	8.56 [5.00-19.49]	12.92 [7.28-20.12]	*KWp* = .14			
Graduated15-20 ECS	5.10 [2.50-9.72]	7.64 [4.96-10.87]	12.39 [4.15-16.27]	***KWp = .016***		*Dp* < .05	
Graduated 20-36 ECS	4.82 [2.07-8.52]	6.40 [2.67-21.00]	5.58 [3.36-13.51]	*KWp* = .056			
Progressive ECS	1.33 [0.78-2.92]	3.37 [1.52-7.57]	3.05 [1.29-7.42]	***KWp = .0006***	***Dp < .05***	***Dp < .001***	
Standing (DV AS)							
Without ECS	10.67 [5.96-20.77]	8.16 [4.57-25.81]	14.61 [8.10-19.70]	*KWp* = .21			
Graduated15-20 ECS	9.97 [6.04-17.64]	10.57 [5.35-18.76]	10.01 [7.64-27.08]	*KWp* = .21			
Graduated 20-36 ECS	9.80 [4.19-17.33]	10.54 [3.04-14.79]	9.29 [6.38-23.01]	*KWp* = .11			
Progressive ECS	8.90 [3.50-17.69]	9.19 [4.53-15.77]	11.54 [6.24-21.13]	*KWp* = .056			

Small saphenous vein (*SSV*) and deep calf vein (*DCV*) cross-sectional area (mm) in normal controls, in limbs with C_{1s}, and in limbs with C_3 or C_5 CEAP category of chronic venous disease, in the supine (*AL*) and in the standing position (*AS*), without and with graduated 15 to 20 mm Hg, graduated 20 to 36 mm Hg, and progressive ECS. Values are provided as median [lower−upper quartile]. Boldface entries indicate statistical significance. *KWp*, *P* value of comparison between groups in Kruskal-Wallis test, followed, if *P* < .05, by Dunn's multiple comparison (Dp).

Supplementary Table XI (online only). Comparison between male and female patients for body mass index (*BMI*) and vein cross-sectional area

	Females (n = 77)	Males (n = 34)	Wilcoxon signed rank test, *P* value
All participants (n = 111)			
BMI ($kg.m^{-2}$)	24.6 [21.5–28.4]	27.3 [24.5–31.4]	**.021**
SSV cross-sectional area (mm^2) Supine position	3.60 [2.12–5.13]	3.96 [2.30–8.68]	.074
Standing position	4.28 [2.17–6.41]	5.49 [3.23–11.17]	**.025**
DCV cross-sectional area (mm^2) supine position	9.04 [5.44–17.88]	10.62 [6.66–17.23]	.502
Standing position	12.18 [5.14–22.11]	10.56 [6.61–19.03]	.931
Controls (n = 54)	**Females (n = 36)**	**Males (n = 18)**	***P* value**
BMI, $kg.m^{-2}$	23.2 [21.3–26.6]	26.6 [23.3–29.4]	.036
SSV cross-sectional area (mm^2) supine position	3.09 [1.76–4.53]	2.95 [1.44–5.86]	.673
Standing position	3.93 [2.07–5.24]	3.55 [2.21–6.47]	.627
DCV cross-sectional area (mm^2) Supine position	8.85 [5.28–14.97]	8.24 [5.71–14.28]	.985
Standing position	11.60 [5.64–20.77]	8.26 [6.08–20.09]	.680

DCV, Deep calf vein; SSV, small saphenous vein.
Boldface entries indicate statistical significance.

Supplementary Table XII (online only). Comparison of small saphenous and deep calf vein (DCV) cross-sectional area between elastic compression stockings (*ECS*) in patients and controls

SSV	Without ECS	Graduated 15-20 mm Hg ECS	Graduated 20-36 mm Hg ECS	Progressive ECS	Friedman *P* value	Without vs graduated 15-20	Without vs graduated 20-36	Without vs progressive	Graduated 15-20 vs graduated 20-36	Graduated 15-20 vs progressive	Graduated 20-36 vs progressive
Supine (SSV-AL)											
Controls	2.94 [1.76-5.18]	1.93 [1.18-4.54]	2.39 [1.53-3.63]	1.45 [0.61-3.08]	***Fp < .0001***			***Dp < .001***		***Dp < .001***	
C_{1s}	3.95 [2.33-4.97]	3.38 [1.82-4.79]	2.68 [1.91-4.33]	2.59 [1.41-4.34]	***Fp = .045***						
C_3 and C_5	4.87 [3.57-7.06]	5.18 [3.32-8.34]	4.18 [3.02-8.85]	3.47 [0.84-5.99]	***Fp < .0001***			***Dp < .001***		***Dp < .001***	***Dp < .05***
Standing (SSV-AS)											
Controls	3.75 [2.12-5.41]	3.30 [2.14-6.07]	3.59 [1.89-5.38]	3.11 [1.69-4.71]	*Fp* = .49						
C_{1s}	4.70 [2.56-6.16]	4.27 [2.93-9.28]	4.29 [3.29-6.22]	3.43 [2.65-5.95]	***Fp = .018***	***Dp < .05***					
C_3 and C_5	7.07 [2.96-9.90]	6.72 [3.39-11.60]	6.69 [3.68-9.99]	6.14 [2.48-11.93]	*Fp* = .15						

DCV	Without ECS	Graduated 15-20 mm Hg ECS	Graduated 20-36 mm Hg ECS	Progressive ECS	Friedman *P* value	Without vs graduated 15-20	Without vs graduated 20-36	Without vs progressive	Graduated 15-20 vs graduated 20-36	Graduated 15-20 vs progressive	Graduated 20-36 vs progressive
Supine (DCV-AL)											
Controls	8.69 [5.70-14.28]	5.10 [2.50-9.72]	4.82 [2.07-8.52]	1.33 [0.78-2.92]	***Fp < .0001***	***Dp < .001***	***Dp < .001***	***Dp < .001***		***Dp < .001***	***Dp < .001***
C_{1s}	8.56 [5.00-19.49]	7.64 [4.96-10.87]	6.40 [2.67-21.00]	3.37 [1.52-7.57]	***Fp = .0014***			***Dp < .001***		***Dp < .05***	
C_3 and C_5	12.92 [7.28-20.12]	12.39 [4.15-16.27]	5.58 [3.36-13.51]	3.05 [1.29-7.42]	***Fp < .0001***			***Dp < .001***		***Dp < .01***	
Standing (DCV-AS)											
Controls	10.67 [5.96-20.77]	9.97 [6.04-17.64]	9.80 [4.19-17.33]	8.90 [3.50-17.69]	*Fp* = .34						
C_{1s}	8.16 [4.57-25.81]	10.57 [5.35-18.76]	10.54 [3.04-14.79]	9.19 [4.53-15.77]	*Fp* = .60						
C_3 and C_5	14.61 [8.10-19.70]	10.01 [7.64-27.08]	9.29 [6.38-23.01]	11.54 [6.24-21.13]	*Fp* = .43						

Fp, P value of analysis of variance in Friedman test, followed, $P < .05$, by Dunn's multiple comparison (*Dp*).
Comparisons between without, with graduated 15 to 20 mm Hg, graduated 20 to 36 mm Hg, and progressive ECS for the cross-sectional area (mm^2) of the small saphenous (*SV*) and of the *deep* calf (*DV*) vein in normal controls, in limbs with C_{1s}, and in limbs with C_3 or C_5 CEAP category of chronic venous disease, in the supine (AL) and in the standing (*AS*) position. Values are provided as median [1st-3rd quartile]. Boldface entries indicate statistical significance.

Supplementary Table XIII (online only). Cross-sectional area of the small saphenous vein (*SSV*) and of the deep calf vein (*DCV*) in the supine and the standing position

SSV	Without ECS	Graduated 15-20 mm Hg ECS	Graduated 20-36 mm Hg ECS	Progressive ECS
Controls				
Supine (SSV AL)	2.94 [1.76-5.18]	1.93 [1.18-4.54]	2.39 [1.53-3.63]	1.45 [0.61-3.08]
Standing (SSV AS)	3.75 [2.12-5.41]	3.30 [2.14-6.07]	3.59 [1.89-5.38]	3.11 [1.69-4.71]
Wilcoxon	**Wp = .005**	**Wp < .0001**	**Wp < .0001**	**Wp < .0001**
C_{1s}				
Supine (SSV AL)	3.95 [2.33-4.97]	3.38 [1.82-4.79]	2.68 [1.91-4.33]	2.59 [1.41-4.34]
Standing (SSV AS)	4.70 [2.56-6.16]	4.27 [2.93-9.28]	4.29 [3.29-6.22]	3.43 [2.65-5.95]
Wilcoxon	**Wp = .005**	**Wp < .0001**	**Wp < .0001**	**Wp < .0001**
C_3 and 5				
Supine (SSV AL)	4.87 [3.57-7.06]	5.18 [3.32-8.34]	4.18 [3.02-8.85]	3.47 [0.84-5.99]
Standing (SSV AS)	7.07 [2.96-9.90]	6.72 [3.39-11.60]	6.69 [3.68-9.99]	6.14 [2.48-11.93]
Wilcoxon	**Wp = .002**	**Wp = .002**	**Wp < .0001**	**Wp < .0001**
DCV				
Controls				
Supine (DCV AL)	8.69 [5.70-14.28]	5.10 [2.50-9.72]	4.82 [2.07-8.52]	1.33 [0.78-2.92]
Standing (DCV AS)	10.67 [5.96-20.77]	9.97 [6.04-17.64]	9.80 [4.19-17.33]	8.90 [3.50-17.69]
Wilcoxon *P*	**Wp = .014**	**Wp < .0001**	**Wp < .0001**	**Wp < .0001**
C_{1s}				
Supine (DV AL)	8.56 [5.00-19.49]	7.64 [4.96-10.87]	6.40 [2.67-21.00]	3.37 [1.52-7.57]
Standing (DCV AS)	8.16 [4.57-25.81]	10.57 [5.35-18.76]	10.54 [3.04-14.79]	9.19 [4.53-15.77]
Wilcoxon *P*	Wp = .50	Wp = .12	Wp = .65	**Wp = .010**
C_3 and 5				
Supine (DCV AL)	12.92 [7.28-20.12]	12.39 [4.15-16.27]	5.58 [3.36-13.51]	3.05 [1.29-7.42]
Standing (DCV AS)	14.61 [8.10-19.70]	10.01 [7.64-27.08]	9.29 [6.38-23.01]	11.54 [6.24-21.13]
Wilcoxon *P*	Wp = .125	Wp = .058	**Wp = .002**	**Wp < .0001**

Wp, P value of comparison between the standing and the supine position in Wilcoxon signed rank test.
Cross-sectional area (in mm^2) of the SSV and of the DCV in the supine (*AL*) and in the standing (*AS*) position in normal controls, in limbs with C_{1s}, and in limbs with C_3 or C_5 CEAP category of chronic venous disease without, with graduated 15-20 mm Hg, with graduated 20-36 mm Hg, and with progressive compression stockings (ECS). Values are provided as median [1st-3rd quartile]. Boldface entries indicate statistical significance.

Supplementary Table XIV (online only). Small saphenous vein (*SSV*) and deep calf vein (*DCV*) relative postural cross-sectional area change

	Controls	C_{1s}	C_3 and C_5	Kruskal-Wallis p	Controls vs C_{1s}	Controls vs C_3 and C_5	C_{1s} vs C_3 and C_5
SSV PAC							
Without ECS	22 [−09 to 42]	19 [−05 to 46]	26 [−05 to 36]	KWp = .99			
Graduated 15-20 mm Hg ECS	31 [11 to 50]	40 [13 to 52]	14 [−05 to 56]	KWp = .66			
Graduated 20-36 mm Hg ECS	32 [13 to 52]	38 [11 to 47]	29 [05 to 47]	KWp = .74			
Progressive ECS	42 [14 to 73]	39 [15 to 52]	46 [29 to 60]	KWp = .34			
Friedman *P* value	***P* = .007**	*P* = .24	*P* = .09				
Without vs graduated 15-20 ECS							
Without vs graduated 20-36 ECS							
Without vs Progressive ECS	***P* < .01**						
Graduated 15-20 vs 20-36 ECS							
Graduated 15-20 vs Progressive ECS							
Graduated 20-36 vs Progressive ECS							
DCV PAC							
Without ECS	17 [−13 to 41]	−12 [−1.17 to 18]	18 [−12 to 35]	KWp = .12			
Graduated 15-20 mm Hg ECS	50 [09 to 71]	34 [−34 to 60]	40 [−24 to 51]	**KWp = .023**		**Dp < .05**	
Graduated 20-36 mm Hg ECS	53 [10 to 76]	08 [−51 to 58]	51 [07 to 71]	KWp = .12			
Progressive ECS	80 [50 to 89]	57 [08 to 78]	62 [44 to 87]	KWp = .09			
Friedman *P* value	**Fp < .0001**	Fp = .13	**Fp < .0001**				
Without vs graduated 15-20 ECS	**Dp < .05**						
Without vs graduated 20-36 ECS	**Dp < .05**						
Without vs progressive ECS	**Dp < .001**		**P < .001**				
Graduated 15-20 vs 20-36 ECS							
Graduated 15-20 vs progressive ECS	**Dp < .001**		**Dp < .01**				
Graduated 20-36 vs progressive ECS							

Fp, P value of differences between ECS categories inf Friedman test, followed, if $P < .05$, by Dunn's multiple comparison test (Dp); *KWp, P* values of differences between groups in *Kruskal*-Wallis test, followed, if $P < .05$, by Dunn's multiple comparison between compression classes (Dp).
The SSV and DCV relative postural cross-sectional area change (*PAC*, in %) from the lying to the standing position in normal controls, in patients with C_{1s}, and in patients with C_3 or C_5 class of chronic venous disease (*CVD*) without and with graduated 15 to 20 mm Hg, graduated 20 to 36 mm Hg, and progressive elastic compression stockings (*ECS*). Values are *provided* as median [1st-3rd quartile]. Boldface entries indicate statistical significance.

Supplementary Table XV (online only). Maximum force applied on the ultrasound probe during the small saphenous vein (*SSV*) compression

	SSV										
	Without ECS	Graduated 15-20 mm Hg ECS	Graduated 20-36 mm Hg ECS	Progressive ECS	Friedman	Without vs Gr 15-20	Without vs Gr 20-36	Without vs progressive	Gr 15-20 vs Gr 20-36	Gr 15-20 vs progressive	Gr 20-36 vs progressive
Supine position											
Controls	1.44 [0.95-1.77]	2.00 [1.60-2.49]	2.03 [1.46-2.52]	2.02 [1.43-2.54]	**Fp < .0001**	**Dp < .001**	**Dp < .001**	**Dp < .001**			
C_{1s}	1.22 [0.87-1.57]	1.93 [1.00-2.86]	1.43 [1.04-2.80]	1.65 [1.22-2.98]	Fp = .06						
C_3 and C_5	1.72 [1.23-2.18]	1.72 [1.35-2.21]	1.89 [1.26-2.32]	1.60 [1.26-2.40]	Fp = .49						
Kruskal-Wallis	KWp = .15	KWp = .34	KWp = .14	KWp = .47							
Controls vs C_{1s}											
Controls vs C_3 and 5											
C_{1s} vs C_3 and 5											
Standing position											
Controls	3.37 [2.63-3.85]	3.22 [2.71-3.99]	3.20 [2.64-4.11]	3.24 [2.73-4.12]	Fp = .996						
C_{1s}	2.88 [2.39-3.82]	3.50 [2.69-4.28]	3.13 [2.55-3.71]	3.44 [2.45-4.39]	Fp = .08						
C_3 and C_5	3.94 [3.12-4.77]	3.98 [3.28-4.64]	3.80 [3.00-4.50]	3.64 [3.03-4.26]	Fp = .30						
Kruskal-Wallis	**KWp = .003**	**KWp = .021**	**KWp = .026**	KWp = .15							
Controls vs C_{1s}											
Controls vs C_3 and 5	Dp<.05	Dp<.05									
C_{1s} vs C_3 and 5	Dp<.01		Dp<.05								
Supine vs standing Wilcoxon signed rank test											
Controls	**Wp < .0001**	**Wp < .0001**	**Wp < .0001**	**Wp < .0001**							
C_{1s}	**Wp = .0009**	**Wp = .0002**	**Wp = .0025**	**Wp = .0048**							
C_3 and C_5	**Wp < .0001**	**Wp < .0001**	**Wp < .0001**	**Wp < .0001**							

Fp, P value of comparison between compression classes in Friedman test, followed, if $P < .05$, by Dunn's multiple comparisons (Dp); *KWp, P* value of differences between groups in Kruskal-Wallis test, followed, if $P < .05$, by Dunn's multiple comparisons (Dp); *Wp, P* value of comparison between the supine and the standing position in Wilcoxon signed rank test.

Maximum force (in Newton) applied on the ultrasound probe during the SSV compression test without and with graduated 15 to 20 mm Hg, graduated 20 to 36 mm Hg, and progressive elastic compression stockings (*ECS*) in normal controls, in limbs with C_{1s}, and in limbs with C_3 or C_5 CEAP category of chronic venous disease. Values are provided as median [1st-3rd quartile]. Boldface entries indicate statistical significance.

Supplementary Table XVI (online only). Maximum force applied on the ultrasound probe during the deep calf vein (*DCV*) compression test

	DCV										
	Without ECS	Graduated 15-20 mm Hg ECS	Graduated 20-36 mm Hg ECS	Progressive ECS	Friedman	Without vs Gr 15-20	Without vs Gr 20-36	Without vs progressive	Gr 15-20 vs Gr 20-36	Gr 15-20 vs progressive	Gr 20-36 vs progressive
Supine position											
Controls	1.83 [1.26-2.54]	2.13 [1.21-2.99]	2.22 [1.50-2.83]	2.04 [1.57-2.84]	***Fp = .023***			*Dp<.05*			
C_{1s}	2.87 [1.59-4.59]	2.86 [1.62-3.76]	2.40 [1.56-3.61]	2.33 [1.41-4.42]	*Fp = .30*						
C_3 and C_5	2.36 [1.72-3.01]	2.30 [1.93-3.97]	2.40 [1.64-3.38]	2.22 [1.70-2.88]	*Fp = .96*						
Kruskal-Wallis	***KWp = .009***	*KWp = .11*	*KWp = .38*	*KWp = .74*							
Controls vs C_{1s}	***Dp < .05***										
Controls vs C_3 and 5											
C_{1s} vs C_3 and 5											
Standing position											
Controls	4.64 [3.75-6.50]	4.50 [3.65-5.87]	4.63 [3.33-5.73]	3.77 [2.93-5.23]	***Fp < .0001***			*Dp<.001*		*Dp<.001*	*Dp<.05*
C_{1s}	5.64 [3.61-6.91]	4.64 [3.21-5.81]	4.61 [3.36-5.93]	4.43 [3.04-6.16]	*Fp = .31*						
C_3 and C_5	5.75 [4.47-7.42]	5.04 [3.54-6.48]	4.95 [3.57-6.62]	5.31 [3.61-6.45]	***Fp = .003***	*Dp<.01*		*Dp<.05*			
Kruskal-Wallis	*KWp = .06*	*KWp = .59*	*KWp = .60*	*KWp = .08*							
Controls vs C_{1s}											
Controls vs C_3 and 5											
C_{1s} vs C_3 and 5											
Supine vs Standing Wilcoxon signed rank test											
Controls	***Wp < .0001***	***Wp < .0001***	***Wp < .0001***	***Wp < .0001***							
C_{1s}	***Wp = .0012***	***Wp = .0001***	***Wp = .0012***	***Wp = .0059***							
C_3 and C_5	***Wp < .0001***	***Wp < .0001***	***Wp < .0001***	***Wp < .0001***							

Fp, P value of comparison between compression classes in Friedman test, followed, if $P < .05$, by Dunn's multiple comparisons (Dp); *KWp, P* value of differences between groups in Kruskal-Wallis test, followed, if $P < .05$, by Dunn's multiple comparisons (Dp); *Wp, P* value of comparison between the supine and the standing position in Wilcoxon signed rank test.
Maximum force (in Newton) applied on the ultrasound probe during the DCV compression test without and with graduated 15 to 20 mm Hg, graduated 20 to 36 mm Hg, and progressive elastic compression stockings (*ECS*) in normal controls, in limbs with C_{1s}, and in limbs with C_3 or C_5 CEAP category of chronic venous disease. Values are provided as median [1st-3rd quartile]. Boldface entries indicate statistical significance.

Supplementary Table XVII (online only). Comparison of the maximum force applied on the ultrasound probe to collapse the vein between the small saphenous vein (SSV) and the deep calf vein (DCV)

SPFmx vs DPFmx	Without ECS	Graduated 15-20 mm Hg ECS	Graduated 20-36 mm Hg ECS	Progressive ECS
Lying position				
Controls	***P = .0004***	*P = .61*	*P = .28*	*P = .20*
C_{1s}	***P = .006***	*P = .08*	*P = .20*	*P = .33*
C_3 and C_5	***P = .0002***	***P = .0007***	***P = .0025***	***P = .02***
Standing position				
Controls	***P < .0001***	***P < .0001***	***P < .0001***	***P = .002***
C_{1s}	***P = .0004***	***P = .0095***	***P = .0003***	*P=.06*
C_3 and C_5	***P < .0001***	***P = .003***	***P = .002***	***P = .0003***

P value of comparison of the maximum force applied on the ultrasound probe to collapse the vein between the SSV (SPFmx) and the DCV (DPFmx) in Wilcoxon signed rank test in normal controls, in limbs with C_{1s}, and in limbs with C_3 or C_5 CEAP category of chronic venous disease, without and with graduated 15-20 mm Hg, graduated 20-36 mm Hg, and progressive elastic compression stockings (*ECS*). Boldface entries indicate statistical significance

Supplementary Table XVIII (online only). Small saphenous vein (SSV) viscoelasticity variables and group comparisons

CPF (N)	Controls	C_{1s}	C_3 and C_5	KWp	N vs C_{1s}	N vs C_3 and C_5	C_{1s} vs C_3 and C_5
Without ECS							
Supine	1.03 [0.75-1.35]	0.87 [0.60-1.23]	1.22 [0.89-1.64]	*KWp = .096*			
Standing	2.71 [2.20-3.13]	2.51 [2.03-3.07]	3.15 [2.54-4.03]	***KWp = .018***		***Dp < .05***	
Wilcoxon	***Wp < .0001***	***Wp < .0001***	***Wp < .0001***				
Graduated 15-20 mm Hg ECS							
Supine	1.40 [1.12-1.79]	1.31 [0.75-1.78]	1.27 [1.05-1.80]	*KWp = .666*			
Standing	2.52 [2.14-3.11]	2.92 [2.32-3.81]	3.43 [2.62-4.11]	***KWp = .0009***		***Dp < .001***	
Wilcoxon	***Wp < .0001***	***Wp = .0004***	***Wp < .0001***				
Graduated 20-36 mm Hg ECS							
Supine	1.51 [0.97-1.90]	1.15 [0.77-1.78]	1.48 [0.93-1.92]	*KWp = .558*			
Standing	2.69 [2.27-3.75]	2.67 [2.21-3.28]	3.16 [2.51-3.81]	*KWp = .075*			
Wilcoxon	***Wp < .0001***	***Wp = .0009***	***Wp < .0001***				
Progressive ECS							
Supine	1.13 [0.40-1.60]	1.07 [0.53-1.35]	1.09 [0.60-1.80]	*KWp = .628*			
Standing	2.54 [1.91-2.95]	2.48 [2.08-3.01]	2.85 [2.20-3.43]	*KWp = .142*			
Wilcoxon	***Wp < .0001***	***Wp = .0004***	***Wp < .0001***				

CPF, probe force measured at vein collapse. Values are provided as median [1st-3rd quartile]; *KWp*, *P* value of comparison between groups in Kruskal-Wallis test, followed, if $P < .05$, by Dunn's multiple comparison (Dp); *Wp*, *P* value of comparison between the supine and the standing position in Wilcoxon signed rank test.
SSV viscoelasticity variables in normal controls, in limbs with C_{1s}, and in limbs with C_3 or C_5 category of chronic venous disease, in the supine and in the standing position, without and with graduated 15-20 mm Hg, graduated 20-36 mm Hg, and progressive elastic compression stockings (*ECS*). Boldface entries indicate statistical significance.

OPF (N)	Controls	C_{1s}	C_3 and C_5	KWp	N vs C_{1s}	N vs C_3 and C_5	C_{1s} vs C_3 and C_5
Without ECS							
Supine	0.36 [0.21-0.56]	0.35 [0.14-0.58]	0.52 [0.19-0.76]	*KWp = .109*			
Standing	0.98 [0.63-1.56]	1.42 [1.19-1.77]	1.76 [1.12-2.07]	***KWp < .0001***	***Dp < .05***	***Dp < .001***	
Wilcoxon	***Wp < .0001***	***Wp < .0001***	***Wp < .0001***				
Graduated 15-20 mm Hg ECS							
Supine	0.51 [0.35-0.75]	0.72 [0.12-1.01]	0.61 [0.32-0.92]	*KWp = .807*			
Standing	1.08 [0.71-1.55]	1.34 [1.04-1.96]	1.69 [1.35-2.35]	***KWp = .0001***		***Dp < .001***	
Wilcoxon	***Wp < .0001***	***Wp = .0012***	***Wp < .0001***				
Graduated 20-36 mm Hg ECS							
Supine	0.45 [0.32-0.64]	0.45 [0.19-0.59]	0.44 [0.20-0.79]	*KWp = .678*			
Standing	1.06 [0.68-1.42]	1.51 [0.99-1.82]	1.63 [1.09-2.18]	***KWp = .0002***		***Dp < .001***	
Wilcoxon	***Wp < .0001***	***Wp = .0004***	***Wp < .0001***				
Progressive ECS							
Supine	0.29 [0.00-0.49]	0.37 [0.04-0.59]	0.33 [0.08-0.48]	*KWp = .922*			
Standing	0.70 [0.46-1.24]	1.23 [0.91-1.58]	1.03 [0.77-1.81]	***KWp = .0012***	***Dp < .01***	***Dp < .05***	
Wilcoxon	***Wp < .0001***	***Wp = .0003***	***Wp < .0001***				

KWp, *P* value of comparison between groups in Kruskal-Wallis test, followed, if $P < .05$, by Dunn's multiple comparison (Dp); *Wp*, *P* value of comparison between the supine and the standing position in Wilcoxon signed rank test.
SSV viscoelasticity variables in normal controls, in limbs with C_{1s}, and in limbs with C_3 or C_5 category of chronic venous disease, in the supine and in the standing position, without and with graduated 15-20 mm Hg, graduated 20-36 mm Hg, and progressive elastic compression stockings (ECS). OPF: probe force measured at vein re-opening. Values are provided as median [1st-3rd quartile]. Boldface entries indicate statistical significance.

DPF (N)	Controls	C_{1s}	C_3 and C_5	KWp	N vs C_{1s}	N vs C_3 and C_5	C_{1s} vs C_3 and C_5
Without ECS							
Supine	0.36 [0.21-0.56]	0.50 [0.32-0.90]	0.65 [0.42-1.02]	KWp = .601			
Standing	1.65 [1.25-2.09]	0.86 [0.59-1.32]	1.35 [0.84-2.21]	KWp = .0021	Dp < .01		
Wilcoxon	Wp < .0001	Wp = .010	Wp < .0001				
Graduated 15-20 mm Hg ECS							
Supine	0.80 [0.64-1.13]	0.74 [0.33-0.10]	0.67 [0.44-0.86]	KWp = .194			
Standing	1.40 [0.95-1.98]	1.42 [1.03-2.26]	1.46 [1.04-2.26]	KWp = .871			
Wilcoxon	Wp < .0001	Wp < .001	Wp < .0001				
Graduated 20-36 mm Hg ECS							
Supine	0.90 [0.54-1.35]	0.78 [0.44-1.39]	0.90 [0.50-1.22]	KWp = .762			
Standing	1.61 [1.32-2.17]	1.21 [0.65-1.64]	1.39 [0.99-2.23]	KWp = .008	Dp < .01		
Wilcoxon	Wp < .0001	Wp = .119	Wp < .0001				
Progressive ECS							
Supine	0.75 [0.37-1.10]	0.64 [0.38-0.83]	0.64 [0.42-1.40]	KWp = .695			
Standing	1.64 [1.12-2.07]	1.24 [0.67-1.86]	1.48 [1.11-2.02]	KWp = .156			
Wilcoxon	Wp < .0001	Wp = .002	Wp < .0001				

KWp, P value of comparison between groups in Kruskal-Wallis test, followed, if $P < .05$, by Dunn's multiple comparison (Dp); *Wp:, P* value of comparison between the supine and the standing position in Wilcoxon signed rank test.
SSV viscoelasticity variables in normal controls, in limbs with C_{1s}, and in limbs with C_3 or C_5 category of chronic venous disease, in the supine and in the standing position, without and with graduated 15-20 mm Hg, graduated 20-36 mm Hg, and progressive elastic compression stockings (ECS). DPF: difference between probe force measured at vein collapse et at vein re-opening. Values are provided as median [1st-3rd quartile].

TAH (N.mm^2)	Controls	C_{1s}	C_3 and C_5	KWp	N vs C_{1s}	N vs C_3 and C_5	C_{1s} vs C_3 and C_5
Without ECS							
Supine	1.24 [0.64-2.14]	1.15 [0.71-2.97]	2.40 [1.65-3.88]	***KWp = .0013***		***Dp < .01***	
Standing	4.16 [2.73-8.43]	4.25 [2.71-5.21]	8.95 [3.87-15.96]	***KWp = .0047***		***Dp < .05***	***P < .05***
Wilcoxon	***Wp < .0001***	***Wp = .0004***	***Wp < .0001***				
Graduated 15-20 mm Hg ECS							
Supine	0.90 [0.51-1.90]	1.41 [0.97-2.09]	2.61 [1.00-4.41]	***KWp = .0052***		***Dp < .01***	
Standing	3.70 [2.15-7.35]	4.53 [2.42-8.75]	8.45 [3.86-15.95]	***KWp = .0035***		***Dp < .01***	
Wilcoxon	***Wp < .0001***	***Wp = .0003***	***Wp < .0001***				
Graduated 20-36 mm Hg ECS							
Supine	1.08 [0.43-1.47]	1.03 [0.63-2.58]	1.99 [1.04-3.98]	***KWp = .0013***		***Dp < .001***	
Standing	4.17 [1.57-7.23]	3.16 [2.31-6.06]	6.46 [3.22-11.25]	*KWp = .069*			
Wilcoxon	***Wp < .0001***	***Wp = .0014***	***Wp < .0001***				
Progressive ECS							
Supine	0.51 [0.13-1.19]	0.92 [0.30-1.79]	0.97 [0.25-3.85]	*KWp = .086*			
Standing	2.69 [1.32-5.93]	3.32 [2.12-6.07]	6.53 [1.87-11.36]	***KWp = .044***		***Dp < .05***	
Wilcoxon	***Wp < .0001***	***Wp = .0015***	***Wp < .0001***				

KWp, P value of comparison between groups in Kruskal-Wallis test, followed, if $P < .05$, by Dunn's multiple comparison (Dp); *TAH,* total area of the *hysteresis* loop; *Wp, P* value of comparison between the supine and the standing position in Wilcoxon signed rank test.
SSV viscoelasticity variables in normal controls, in limbs with C_{1s}, and in limbs with C_3 or C_5 class of chronic venous disease, in the supine and in the standing position, without and graduated 15-20 mm Hg, graduated 20-36 mm Hg, and progressive elastic compression stockings (ECS). Values are provided as median [1st-3rd quartile]. Boldface entries indicate statistical significance.

CAH (N.mm^2)	Controls	C_{1s}	C_3 and C_5	KWp	N vs C_{1s}	N vs C_3 and C_5	C_{1s} vs C_3 and C_5
Without ECS							
Supine	0.38 [0.13-0.70]	0.31 [0.08-1.02]	0.65 [0.32-1.68]	*KWp = .125*			
Standing	1.36 [1.02-3.52]	1.70 [0.84-2.42]	3.70 [1.16-7.13]	***KWp = .011***		***Dp < .05***	***Dp < .05***
Wilcoxon	***Wp < .0001***	***Wp = .0001***	***Wp < .0001***				
Graduated 15-20 mm Hg ECS							
Supine	0.23 [0.07-0.42]	0.42 [0.16-0.58]	0.89 [0.23-1.45]	***KWp = .0014***		***Dp < .001***	
Standing	1.42 [0.69-3.15]	1.16 [0.63-2.38]	3.60 [1.42-6.90]	***KWp = .0009***		***Dp < .01***	***Dp < .01***
Wilcoxon	***Wp < .0001***	***Wp = .0018***	***Wp < .0001***				
Graduated 20-36 mm Hg ECS							
Supine	0.17 [0.00-0.36]	0.24 [0.12-0.78]	0.69 [0.35-1.82]	***KWp < .0001***		***Dp < .001***	
Standing	1.05 [0.38-2.73]	1.16 [0.65-2.73]	2.49 [1.14-4.69]	***KWp = .0068***		***Dp < .01***	
Wilcoxon	***Wp < .0001***	***Wp = .0012***	***Wp = .0001***				
Progressive ECS							
Supine	0.00 [-0.02-0.30]	0.12 [0.00-0.57]	0.10 [-0.04-0.46]	*KWp = .385*			
Standing	0.79 [0.27-2.16]	1.31 [0.29-2.16]	2.37 [0.49-3.98]	*KWp = .064*			
Wilcoxon	***Wp < .0001***	***Wp = .0119***	***Wp < .0001***				

CAH, Area of the compression phase of the *hysteresis* loop; *KWp, P* value of comparison between groups in Kruskal-Wallis test, followed, if $P < .05$, by Dunn's multiple comparison (Dp); *Wp, P* value of comparison between the supine and the standing position in Wilcoxon signed rank test.
SSV viscoelasticity variables in normal controls, in limbs with C_{1s}, and in limbs with C_3 or C_5 category of chronic venous disease, in the supine and in the standing position, without and with graduated 15-20 mm Hg, graduated 20-36 mm Hg, and progressive elastic compression stockings (*ECS*). Values are provided as median [1st-3rd quartile]. Boldface entries indicate statistical significance.

DAH (N.mm^2)	Controls	C_{1s}	C_3 and C_5	KWp	N vs C_{1s}	N vs C_3 and C_5	C_{1s} vs C_3 and C_5
Without ECS							
Supine	0.79 [0.42-1.46]	0.75 [0.58-1.84]	1.86 [1.07-2.54]	KWp = .0003		Dp < .001	
Standing	2.72 [1.49-5.05]	2.28 [1.37-3.85]	4.24 [2.02-9.32]	KWp = .0185		Dp < .05	*P* < .05
Wilcoxon	Wp < .0001	Wp = .0022	Wp < .0001				
Graduated 15-20 mm Hg ECS							
Supine	0.65 [0.39-1.44]	1.08 [0.63-1.79]	1.74 [0.37-2.41]	KWp = .089			
Standing	2.15 [1.18-4.19]	2.73 [1.67-7.25]	5.16 [1.77-9.08]	KWp = .006		Dp < .01	
Wilcoxon	Wp < .0001	Wp = .0005	Wp < .0001				
Graduated 20-36 mm Hg ECS							
Supine	0.80 [0.33-1.38]	0.76 [0.52-1.65]	1.15 [0.62-1.84]	KWp = .102			
Standing	2.39 [1.31-5.30]	2.19 [1.42-3.89]	3.27 [1.40-7.39]	KWp = .453			
Wilcoxon	Wp < .0001	Wp = .0016	Wp < .0001				
Progressive ECS							
Supine	0.50 [0.13-0.94]	0.74 [0.27-1.75]	1.03 [0.38-3.01]	KWp = .045		Dp < .05	
Standing	1.91 [1.04-3.80]	2.03 [1.28-3.42]	3.78 [1.00-7.02]	KWp = .100			
Wilcoxon	Wp < .0001	Wp = .0068	Wp < .0001				

DAH, Area of the decompression phase of the *hysteresis* loop. Values are provided as median [1st-3rd quartile]; *KWp, P* value of comparison between groups in Kruskal-Wallis test, followed, if $P < .05$, by Dunn's multiple comparison (Dp); *Wp:, P* value of comparison between the supine and the standing position in Wilcoxon signed rank test.SSV viscoelasticity variables in normal controls, in limbs with C_{1s}, and in limbs with C_3 or C_5 category of chronic venous disease, in the supine and in the standing position, without and with graduated 15-20 mm Hg, graduated 20-36 mm Hg, and progressive elastic compression stockings (*ECS*).

S1H ($mm^2.N^{-1}$)	Controls	C_{1s}	C_3 and C_5	KWp	N vs C_{1s}	N vs C_3 and C_5	C_{1s} vs C_3 and C_5
Without ECS							
Supine	−1.06 [−1.86 to −0.47]	−1.98 [−3.42 to −0.53]	−2.04 [−3.28 to −1.10]	***KWp = .0074***		***Dp < .05***	
Standing	−0.37 [−0.68 to −0.24]	−0.55 [−1.37 to −0.28]	−0.52 [−0.91 to −0.23]	*KWp = .297*			
Wilcoxon	***Wp < .0001***	***Wp = .004***	***Wp < .0001***				
Graduated 15-20 mm Hg ECS							
Supine	−0.68 [−1.38 to −0.35]	−1.54 [−2.70 to −0.72]	−1.44 [−2.45 to −0.75]	***KWp = .0025***	***Dp < .05***	***Dp < .01***	
Standing	−0.42 [−0.76 to −0.20]	−0.76 [−1.32 to −0.39]	−0.45 [−1.86 to −0.31]	***KWp = .030***	***Dp < .05***		
Wilcoxon	***Wp = .034***	***Wp = .004***	***Wp = .0003***				
Graduated 20-36 mm Hg ECS							
Supine	−0.68 [−1.64 to −0.26]	−0.95 [−1.46 to −0.17]	−0.81 [−2.15 to −0.27]	*KWp = .637*			
Standing	−0.53 [−0.88 to −0.23]	−0.54 [−1.03 to −0.33]	−0.83 [−1.43 to −0.33]	*KWp = .078*			
Wilcoxon	***Wp = .012***	*Wp = .13*	*Wp = .25*				
Progressive ECS							
Supine	−0.55 [−1.19 to −0.02]	−1.69 [−2.33 to −0.57]	−1.65 [−3.08 to −0.53]	***KWp = .024***		***Dp < .05***	
Standing	−0.52 [−1.03 to −0.20]	−0.49 [−1.54 to −0.23]	−0.78 [−1.68 to −0.27]	*KWp = .301*			
Wilcoxon	*Wp = .505*	*Wp = .214*	***Wp = .0004***				

KWp, *P* value of comparison between groups in Kruskal-Wallis test, followed, if $P < .05$, by Dunn's multiple comparison (Dp); *S1H*, first slope of the compression phase of the *hysteresis* loop. Values are provided as median [1st-3rd quartile]; *Wp*, *P* value of comparison between the supine and the standing position in Wilcoxon signed rank test.
SSV vein viscoelasticity variables in normal controls, in limbs with C_{1s}, and in limbs with C_3 or C_5 category of chronic venous disease, in the supine and in the standing position, without and with graduated 15-20 mm Hg, graduated 20-36 mm Hg, and progressive elastic compression stockings (*ECS*).
Boldface entries indicate statistical significance.

S2H ($mm^2.N^{-1}$)	Controls	C_{1s}	C_3 and C_5	KWp	N vs C_{1s}	N vs C_3 and C_5	C_{1s} vs C_3 and C_5
Without ECS							
Supine	−5.49 [−8.37 to −3.41]	−6.52 [−10.31 to −3.15]	−9.21 [−15.45 to −3.54]	*KWp = .082*			
Standing	−2.71 [−4.07 to −1.86]	−3.46 [−7.68 to −1.83]	−4.29 [−6.68 to −2.96]	***KWp = .0099***		***Dp < .01***	
Wilcoxon	***Wp < .0001***	***Wp = .01***	***Wp < .0001***				
Graduated 15-20 mm Hg ECS							
Supine	−2.31 [−4.07 to −1.28]	−6.07 [−8.08 to −1.64]	−6.33 [−14.48 to −2.83]	***KWp = .003***		***Dp < .01***	
Standing	−2.73 [−4.74 to −1.63]	−3.30 [−4.79 to −1.49]	−3.81 [−7.80 to −2.21]	*KWp = .094*			
Wilcoxon	***Wp < .0001***	***Wp = .001***	***Wp < .0001***				
Graduated 20-36 mm Hg ECS							
Supine	−2.04 [−4.04 to −0.92]	−3.17 [−5.54 to −2.29]	−3.87 [−10.70 to −1.93]	***KWp = .0025***		***Dp < .01***	
Standing	−2.53 [−3.30 to −1.37]	−3.88 [−5.62 to −2.33]	−4.02 [−7.14 to −2.35]	***KWp = .0008***		***Dp < .01***	
Wilcoxon	***Wp < .0001***	*Wp = .119*	***Wp < .0001***				
Progressive ECS							
Supine	−1.64 [−3.02 to −0.24]	−2.29 [−7.32 to −1.26]	−2.76 [−9.08 to −0.60]	*0.139*			
Standing	−2.50 [−4.51 to −0.89]	−3.51 [−5.66 to −1.50]	−4.52 [−6.53 to −1.58]	*0.062*			
Wilcoxon	***Wp < .0001***	***Wp = .002***	***Wp = .0001***				

KWp, *P* value of comparison between groups in Kruskal-Wallis test, followed, if $P < .05$, by Dunn's multiple comparison (Dp); *S2H*, second slope of the compression phase of the *hysteresis* loop. Values are provided as median [1st-3rd quartile]; *Wp*, *P* value of comparison between the supine and the standing position in Wilcoxon signed rank test.
SSV vein viscoelasticity variables in normal controls, in limbs with C_{1s}, and in limbs with C_3 or C_5 category of chronic venous disease, in the supine and in the standing position, without and with graduated 15-20 mm Hg, graduated 20-36 mm Hg, and progressive elastic compression stockings (*EC-S*).
Boldface entries indicate statistical significance.

Supplementary Table XIX (online only). Small saphenous vein (SSV) viscoelasticity variables without and with elastic compression stockings (*ECS*)

CPF (N)	Without ECS	Graduated 15-20 mm Hg ECS	Graduated 20-36 mm Hg ECS	Progressive ECS	*P* value	Without vs graduated 15-20	Without vs graduated 20-36	Without vs progressive	Graduated 15-20 vs 20-36	Graduated 15-20 vs progressive	Graduated 20-36 vs progressive
Supine											
Controls	1.03 [0.75-1.35]	1.40 [1.12-1.79]	1.51 [0.97-1.90]	1.13 [0.40-1.60]	***P* = .029**						
C_{1s}	0.87 [0.60-1.23]	1.31 [0.75-1.78]	1.15 [0.77-1.78]	1.07 [0.53-1.35]	*P* = .257						
C_3 and C_5	1.22 [0.89-1.64]	1.27 [1.05-1.80]	1.48 [0.93-1.92]	1.09 [0.60-1.80]	*P* = .102						
Standing											
Controls	2.71 [2.20-3.13]	2.52 [2.14-3.11]	2.69 [2.27-3.75]	2.54 [1.91-2.95]	*P* = .061						
C_{1s}	2.51 [2.03-3.07]	2.92 [2.32-3.81]	2.67 [2.21-3.28]	2.48 [2.08-3.01]	***P* = .046**						
C_3 and C_5	3.15 [2.54-4.03]	3.43 [2.62-4.11]	3.16 [2.51-3.81]	2.85 [2.20-3.43]	*P* = .342						
OPF (N)											
Supine											
Controls	0.36 [0.21-0.56]	0.51 [0.35-0.75]	0.45 [0.32-0.64]	0.29 [0.00-0.49]	***P* < .0001**	***P* < .05**			***P* < .05**	***P* < .001**	
C_{1s}	0.35 [0.14-0.58]	0.72 [0.12-1.01]	0.45 [0.19-0.59]	0.37 [0.04-0.59]	*P* = .204						
C_3 and C_5	0.52 [0.19-0.76]	0.61 [0.32-0.92]	0.44 [0.20-0.79]	0.33 [0.08-0.48]	***P* = .001**			***P* < .05**		***P* < .001**	***P* < .05**
Standing											
Controls	0.35 [0.14-0.58]	0.72 [0.12-1.01]	0.45 [0.19-0.59]	0.37 [0.04-0.59]	*P* = .204						
C_{1s}	0.52 [0.19-0.76]	0.61 [0.32-0.92]	0.44 [0.20-0.79]	0.33 [0.08-0.48]	***P* = .001**			***P* < .05**		***P* < .001**	***P* < .05**
C_3 and C_5	0.36 [0.21-0.56]	0.51 [0.35-0.75]	0.45 [0.32-0.64]	0.29 [0.00-0.49]	***P* < .0001**	***P* < .05**			***P* < .05**	***P* < .001**	

CPF, Probe force measured at vein collapse; *OPF,* probe force measured at vein reopening.
SSV viscoelasticity variables in the supine and the standing position in normal controls, in limbs with C_{1s}, and in limbs with C_3 or C_5 CEAP category of chronic venous disease, and *differences* between without, with graduated 15-20 mm Hg, with graduated 20-36 mm Hg, and with progressive compression stockings (*ECS*). Values are provided as median [1st-3rd quartile]. Ft: *P* values of comparison between without, with class 2, with class 3, and with progressive elastic compression stockings (ECS) in Friedman test, followed, is $P < .05$, by *P* value of differences between pairs of ECS categories in Dunn's multiple comparison. Boldface entries indicate statistical significance.

DPF (N)	Without ECS	Graduated 15-20 mm Hg ECS	Graduated 20-36 mm Hg ECS	Progressive ECS	*P* value	Without vs graduated 15-20	Without vs graduated 20-36	Without vs progressive	Graduated 15-20 vs 20-36	Graduated 15-20 vs progressive	Graduated 20-36 vs progressive
Supine											
Controls	0.36 [0.21-0.56]	0.80 [0.64-1.13]	0.90 [0.54-1.35]	0.75 [0.37-1.10]	*P* = .068						
C_{1s}	0.50 [0.32-0.90]	0.74 [0.33-0.10]	0.78 [0.44-1.39]	0.64 [0.38-0.83]	*P* = .172						
C_3 and C_5	0.65 [0.42-1.02]	0.67 [0.44-0.86]	0.90 [0.50-1.22]	0.64 [0.42-1.40]	*P* = .205						
Standing											
Controls	1.65 [1.25-2.09]	1.40 [0.95-1.98]	1.61 [1.32-2.17]	1.64 [1.12-2.07]	***P* = .040**				***P* < .05**		
C_{1s}	0.86 [0.59-1.32]	1.42 [1.03-2.26]	1.21 [0.65-1.64]	1.24 [0.67-1.86]	***P* = .046**						
C_3 and C_5	1.35 [0.84-2.21]	1.46 [1.04-2.26]	1.39 [0.99-2.23]	1.48 [1.11-2.02]	*P* = .230						
TAH ($N.mm^2$)											
Supine											
Controls	1.24 [0.64-2.14]	0.90 [0.51-1.90]	1.08 [0.43-1.47]	0.51 [0.13-1.19]	***P* = .005**			***P* < .01**			
C_{1s}	1.15 [0.71-2.97]	1.41 [0.97-2.09]	1.03 [0.63-2.58]	0.92 [0.30-1.79]	*P* = .782						
C_3 and C_5	2.40 [1.65-3.88]	2.61 [1.00-4.41]	1.99 [1.04-3.98]	0.97 [0.25-3.85]	***P* = .012**			***P* < .01**			
Standing											
Controls	4.16 [2.73-8.43]	3.70 [2.15-7.35]	4.17 [1.57-7.23]	2.69 [1.32-5.93]	*P* = .101						
C_{1s}	4.25 [2.71-5.21]	4.53 [2.42-8.75]	3.16 [2.31-6.06]	3.32 [2.12-6.07]	***P* = .024**					***P* < .05**	
C_3 and C_5	8.95 [3.87-15.96]	8.45 [3.86-15.95]	6.46 [3.22-11.25]	6.5 [1.87-11.36]	*P* = .138						

DPF, Difference between probe force measured at vein collapse and at vein reopening; *TAH,* total area of the *hysteresis* loop.
SSV viscoelasticity variables in the supine and the standing position in normal controls, in limbs with C_{1s}, and in limbs with C_3 or C_5 CEAP category of chronic venous disease, and *differences* between without, with graduated 15-20 mm Hg, with graduated 20-36 mm Hg, and with progressive compression stockings (ECS).
Values are provided as median [1st-3rd quartile]. Ft: *P* values of comparison between without, with class 2, with class 3, and with progressive elastic compression stockings (ECS) in *Friedman* test, followed, is $P < .05$, by *P* value of differences between pairs of ECS categories in Dunn's multiple comparison. Boldface entries indicate statistical significance.

CAH (N.mm^2)	Without ECS	Graduated 15-20 mm Hg ECS	Graduated 20-36 mm Hg ECS	Progressive ECS	*P* value	Without vs graduated 15-20	Without vs graduated 20-36	Without vs progressive	Graduated 15-20 vs 20-36	Graduated 15-20 vs progressive	Graduated 20-36 vs progressive
Supine											
Controls	0.38 [0.13-0.70]	0.23 [0.07-0.42]	0.17 [0.00-0.36]	0.00 [-0.02-0.30]	***P* < .0001**		***P* < .01**	***P* < .001**		***P* < .01**	
C_{1s}	0.31 [0.08-1.02]	0.42 [0.16-0.58]	0.24 [0.12-0.78]	0.12 [0.00-0.57]	*P* = .334						
C_3 and C_5	0.65 [0.32-1.68]	0.89 [0.23-1.45]	0.69 [0.35-1.82]	0.10 [-0.04-0.46]	***P* = .0006**			***P* < .01**		***P* < .01**	***P* < .05**
Standing											
Controls	1.36 [1.02-3.52]	1.42 [0.69-3.15]	1.05 [0.38-2.73]	0.79 [0.27-2.16]	*P* = .10						
C_{1s}	1.70 [0.84-2.42]	1.16 [0.63-2.38]	1.16 [0.65-2.73]	1.31 [0.29-2.16]	*P* = .60						
C_3 and C_5	3.70 [1.16-7.13]	3.60 [1.42-6.90]	2.49 [1.14-4.69]	2.37 [0.49-3.98]	*P* = .46						
DAH (N.mm^2)											
Supine											
Controls	0.79 [0.42-1.46]	0.65 [0.39-1.44]	0.80 [0.33-1.38]	0.50 [0.13-0.94]	*P* = .066						
C_{1s}	0.75 [0.58-1.84]	1.08 [0.63-1.79]	0.76 [0.52-1.65]	0.74 [0.27-1.75]	*P* = .859						
C_3 and C_5	1.86 [1.07-2.54]	1.74 [0.37-2.41]	1.15 [0.62-1.84]	1.03 [0.38-3.01]	***P* = .022**			***P* < .05**			
Standing											
Controls	2.72 [1.49-5.05]	2.15 [1.18-4.19]	2.39 [1.31-5.30]	1.91 [1.04-3.80]	*P* = .123						
C_{1s}	2.28 [1.37-3.85]	2.73 [1.67-7.25]	2.19 [1.42-3.89]	2.03 [1.28-3.42]	***P* = .0004**	**< .01**			**< .001**	**< .01**	
C_3 and C_5	4.24 [2.02-9.32]	5.16 [1.77-9.08]	3.27 [1.40-7.39]	3.78 [1.00-7.02]	*P* = .173						

CAH, Area of the compression phase of the *hysteresis* loop; *DAH,* area of the decompression phase of the *hysteresis* loop; *DPF,* difference between probe force measured at vein collapse and at vein re-opening; *Ft, P* values of comparison between without, with class 2, with class 3, and with progressive elastic compression stockings (ECS) in Friedman test, followed, is $P < .05$, by *P* value of differences between pairs of compression categories in Dunn's multiple comparison.
SSV viscoelasticity variables in the supine and the standing position in normal controls, in limbs with C_{1s}, and in limbs with C_3 or C_5 CEAP category of chronic venous disease, and *differences* between without, with graduated 15-20 mm Hg, with graduated 20-36 mm Hg, and with progressive compression stockings (ECS). Values are provided as median [1st-3rd quartile]. Boldface entries indicate statistical significance.

S1H (mm^2.N^{-1})	Without ECS	Graduated 15-20 mm Hg ECS	Graduated 20-36 mm Hg ECS	Progressive ECS	*P* value	Without vs graduated 15-20	Without vs graduated 20-36	Without vs progressive	Graduated 15-20 vs 20-36	Graduated 15-20 vs progressive	Graduated 20-36 vs progressive
Supine											
Controls	−1.06 [−1.86 to −0.47]	−0.68 [−1.38 to −0.35]	−0.68 [−1.64 to −0.26]	−0.55 [−1.19 to −0.02]	*P* = .069						
C_{1s}	−1.98 [−3.42 to −0.53]	−1.54 [−2.70 to −0.72]	−0.95 [−1.46 to −0.17]	−1.69 [−2.33 to −0.57]	*P* = .257						
C_3 and C_5	−2.04 [−3.28 to −1.10]	−1.44 [−2.45 to −0.75]	−0.81 [−2.15 to −0.27]	−1.65 [−3.08 to −0.53]	*P* = .201						
Standing											
Controls	−0.37 [−0.68 to −0.24]	−0.42 [−0.76 to −0.20]	−0.53 [−0.88 to −0.23]	−0.52 [−1.03 to −0.20]	*P* = .438						
C_{1s}	−0.55 [−1.37 to −0.28]	−0.76 [−1.32 to −0.39]	−0.54 [−1.03 to −0.33]	−0.49 [−1.54 to −0.23]	*P* = .577						
C_3 and C_5	−0.52 [−0.91 to −0.23]	−0.45 [−1.86 to −0.31]	−0.83 [−1.43 to −0.33]	−0.78 [−1.68 to −0.27]	*P* = .136						
S2H (mm^2.N^{-}−^{1})											
Supine											
Controls	−5.49 [−8.37 to −3.41]	−2.31 [−4.07 to −1.28]	−2.04 [−4.04 to −0.92]	−1.64 [−3.02 to −0.24]	***P* < .0001**	***P* < .01**	***P* < .001**	***P* < .001**			
C_{1s}	−6.52 [−10.31 to −3.15]	−6.07 [−8.08 to −1.64]	−3.17 [−5.54 to −2.29]	−2.29 [−7.32 to −1.26]	*P* = .211						
C_3 and C_5	−9.21 [−15.45 to −3.54]	−6.33 [−14.48 to −2.83]	−3.87 [−10.7 to −1.93]	−2.76 [−9.08 to −0.60]	***P* = .0004**			***P* < .001**		***P* < .05**	
Standing											
Controls	−2.71 [−4.07 to −1.86]	−2.73 [−4.74 to −1.63]	−2.53 [−3.30 to −1.37]	−2.50 [−4.51 to −0.89]	*P* = .305						
C_{1s}	−3.46 [−7.68 to −1.83]	−3.30 [−4.79 to −1.49]	−3.88 [−5.62 to −2.33]	−3.51 [−5.66 to −1.50]	*P* = .669						
C_3 and C_5	−4.29 [−6.68 to −2.96]	−3.81 [−7.80 to −2.21]	−4.02 [−7.14 to −2.35]	−4.52 [−6.53 to −1.58]	*P* = .303						

DPF, Difference between probe force measured at vein collapse and at vein re-opening. CPF: probe force measured at vein collapse; OPF, probe force measured at vein re-opening; DPF, difference between probe force measured at vein collapse et at vein re-opening; TAH, total area of the hysteresis loop; CAH, Area of the compression phase of the hysteresis loop; DAH, Area of the decompression phase of the hysteresis loop; S1H, first slope of the compression phase of the hysteresis loop; S2H, Second slope of the compression phase of the hysteresis loop. *Ft, P* values of comparison between without, with class 2, with class 3, and with progressive elastic compression stockings (ECS) in Friedman test, followed, is $P < .05$, by *P* value of differences between pairs of ECS categories in Dunn's multiple comparison; *S1H,* first slope of the compression phase of the *hysteresis* loop; *S2H;* second slope of the decompression phase of the *hysteresis* loop.
SSV viscoelasticity variables in the supine and the standing position in normal controls, in limbs with C_{1s}, and in limbs with C_3 or C_5 CEAP category of chronic venous disease, and differences between without, with graduated 15-20 mm Hg, with graduated 20-36 mm Hg, and with progressive compression stockings (*ECS*). Values are provided as median [1st-3rd quartile]. Boldface entries indicate statistical significance.

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