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Great Saphenous Vein Diameter at the Saphenofemoral Junction and Proximal Thigh as Parameters of Venous Disease Class

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WHAT THIS PAPER ADDS?

Measuring great saphenous vein (GSV) diameter is standard in pre-interventional assessment of varicose disorders, but has never been properly validated. This work assessed the relative value of measuring GSV diameter at the most often used sites: the sapheno-femoral junction and the proximal thigh. We found a better correlation of the latter with reflux and both higher sensitivity and specificity for clinical disease severity. A conversion factor was calculated and used to revise published data. The conversion factor enabled comparison of venous disease severity of patients included in 10 interventional series with preoperative GSV measurements taken either at the sapheno-femoral junction or at the proximal thigh.

Background: Great saphenous vein (GSV) incompetence is involved in the majority of cases of varicose disease. Standardised pre-interventional assessment is required to analyse the relative merit of treatment modalities. We weighed GSV diameter measurement at the sapheno-femoral junction (SFJ) against measurement at the proximal thigh 15 cm distal to the groin (PT), established a conversion factor and applied it to selected literature data.
Methods: Legs with untreated isolated GSV reflux and varices limited to its territory and control legs were studied clinically, with duplex ultrasound and photoplethysmography. GSV diameters were measured at both the SFJ and the PT. A conversion factor was calculated and used to compare published data.
Results: Of 182 legs, 60 had no GSV reflux (controls; group I), 51 had above-knee GSV reflux only (group II) and 71 had GSV reflux above and below knee (group III). GSV diameters in group I measured 7.5 mm ($\pm$1.8) at the SFJ and 3.7 mm ($\pm$0.9) at the PT. In groups II and III, they measured 10.9 mm ($\pm$3.9) at the SFJ and 6.3 mm ($\pm$1.9) at the PT ($p < 0.001$ each). Measurement at the PT revealed higher sensitivity and specificity to predict reflux and clinical class. Good correlation between sites of measurement ($r = 0.77$) allowed a conversion factor (SFJ = 1.767 * PT, PT = 0.566*SFJ) to be applied to pre-interventional data of published studies.
Conclusions: GSV diameter correlates with clinical class, measurement at the PT being more sensitive and more specific than measurement at the SFJ. Applying the conversion factor to published data suggests that some studies included patients with minor disease.

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Varicose disease affects one third of the population[1] and has an impact on morbidity, quality of life and health costs. The great saphenous vein (GSV) is involved in the majority of cases. Symptoms include distressing feelings of swelling and heaviness and frank pain. Objective findings are meandering and dilated superficial veins, oedema, dermatitis, dermatosclerosis and skin ulceration. These manifestations are the consequence of long-standing volume overload and hypertension in cutaneous veins caused by wall distension, valve incompetence, blood flow abnormality and secondary phenomena such as allergy and inflammation.

Treatment is directed towards abolition of venous reflux. For decades, this has been accomplished by ligation of the GSV at its junction with the common femoral vein (CFV) and vein stripping, first of the entire GSV, later limited to its refluxing part. In the last decades, alternative options became available, such as haemodynamic surgery,[2–5] endovenous thermal ablation[6–8] and foam sclerotherapy.[9] Duplex ultrasound is widely employed to guide these interventions.

Comparison of treatment modalities requires exact documentation of the clinical, anatomical and functional situation prior to whichever treatment is given.[10,11] Reflux

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and GSV diameter measurements may serve as surrogate parameters for disease severity and provide criteria for planning interventions and monitoring outcome. GSV diameters have been assessed at various sites with different techniques: upright or recumbent patient position, cross-sectional or longitudinal imaging, and various sites of interest. Measurements are regularly made at the sapheno-femoral junction (SFJ), above or below the pre-terminal valve, and anywhere at the thigh. A consensus-based manual recommends two sites where GSV diameters should be measured, 3 cm below the SFJ and mid-thigh,[10] while earlier studies used a site 15 cm below the SFJ.[12,13] Thus far, neither the clinical relevance of these measurements nor the relative significance of the site of measurement has been clarified.

The aim of this study was to investigate a possible correlation of GSV diameters measured at the SFJ and the proximal thigh (PT) with the importance of the venous disorder and to establish a conversion factor usable to compare published data.

METHODS

An anatomical and functional survey of the GSV was undertaken in consecutive outpatients who consulted with the suspicion or presence of a primary venous disorder. It was a practitioner-initiated study performed in a vein clinic in Germany between October and December 2009. The protocol was accepted by the Ethics Committee of the State Medical Chamber of Lower Saxony, Germany.

The criterion for patient inclusion was the presence of a leg with isolated GSV reflux and varices limited to its territory. Eligible legs were included irrespective of the findings on the other leg. Exclusion criteria were previous treatment of the index leg for varicose veins and its complications, deep venous reflux, acute disorders (thrombosis, phlebitis and cellulitis) and lymphoedema. Candidates with known pregnancy, age below 18 years and any concomitant overt health problem were excluded.

Colour-coded duplex ultrasound examinations were performed by a single investigator with a General Electric Logic 5 colour-coded duplex scanner fitted with a 7.5-MHz linear probe.[10,14] The GSV was examined in the standing position applying toe movements, manual compression and decompression as well as Valsalva manoeuvres to assess orthograde flow and reflux. Reflux lasting longer than 1 s was considered pathologic.[15]

The detailed anatomical and functional ultrasound study was the basis for selection and sorting of legs. Included were legs with GSV reflux beginning at the terminal or the pre-terminal valve and escaping through a mid-thigh branch vein (GSV incompetence above knee only − group II (As_2)) or escaping through a lower leg branch vein (GSV incompetence above and below knee − group III ($As_{2,3}$)). No assessment was made of dilated distal branch veins and eventually incompetent perforator veins. Excluded were legs with reflux through the terminal and pre-terminal valve escaping through the anterior or the posterior accessory veins with competent valves in the GSV just distal to the groin. Further were excluded legs with no reflux in the GSV trunk at the PT but with reflux in the distal portion, as seen in cases with incompetence of thigh perforators, reflux from the short saphenous vein through a Giacomini anastomosis or incompetence of superficial branches joining the GSV at mid thigh. Legs with no GSV reflux but meeting the other inclusion and exclusion criteria were recruited as controls (group I).

Clinical findings were documented according to the highest CEAP (Clinical, etiologic, anatomic and pathophysiologic) class. Legs could range from teleangiectasies (C1) to healed venous ulcers (C5). In all cases, the aetiology was primary (Ep) and pathophysiology reflux (Pr). The anatomy was varicose GSV trunk with ($As_{2\pm3+5}$) or without (A_{2+3}) branch varices. Findings in control legs could be C0, C0s, C1, C2 (Ep, As_5 and Pr) and C3.

Vein diameters were measured holding the probe transversely with no pressure. Duplicate measurements were taken at two sites: at the SFJ distal to the terminal valve and 15 cm below the junction. This site, chosen by CHIVA (Conservative ambulatory haemodynamic management of VAricose veins) Group members, shows parallel walls of the GSV and is located above the junction of the most proximal branch veins.[12,13]

Photoplethysmography was performed with the ELCAT Vasoquant® instrument. Muscle pump activity is described as blanching of the skin, in %. Refilling time to 100% is given in seconds.

Power analysis was based on data of an unpublished pilot study, which revealed a Pearson's $r = 0.8$ for the comparison of GSV diameters measured simultaneously at the SFJ and PT. In this study, we intended to differentiate between three groups. Power analysis asked for inclusion of 46 participants per group to discriminate between Pearson's r of 0.7 and 0.9 with a statistical power of 80%. Therefore, a study was set up with 60 consecutive patients per group. Subject allocation was planned to be halted when 60 control legs and 120 legs of groups II and III were included.

Data analysis was performed with Statistical Package for the Social Sciences (SPSS) 13.0. To compare subgroups, chi-squared tests for non-parametric and *t*-tests or Analysis of Variance (ANOVA) for parametric data were applied. Pearson correlations were calculated to compare vein diameters with other parameters. A $p < 0.05$ was considered significant. Specificity and sensitivity were calculated taking the diameter values of subjects without reflux as threshold values (mean, mean+1SD and mean + 2SD). The discriminating power of diameters measured at the SFJ and the PT for reflux and C-classes 2−5 was estimated by calculating Area Under the Receiver Operating Characteristic (AUROC) curves and 95% confidence intervals (CIs).

A conversion factor was established, which allowed comparison of the vein diameter measured at the SFJ with the diameter determined at the PT. A Pearson's $r \geq 0.7$ was considered to be high enough to permit the use of a linear regression model without entering a constant and to calculate a conversion factor between the two variables (diameter SFJ $= \beta_1$ * diameter PT and diameter PT $= \beta_2$ * diameter SFJ with $\beta_1 = 1/\beta_2$).

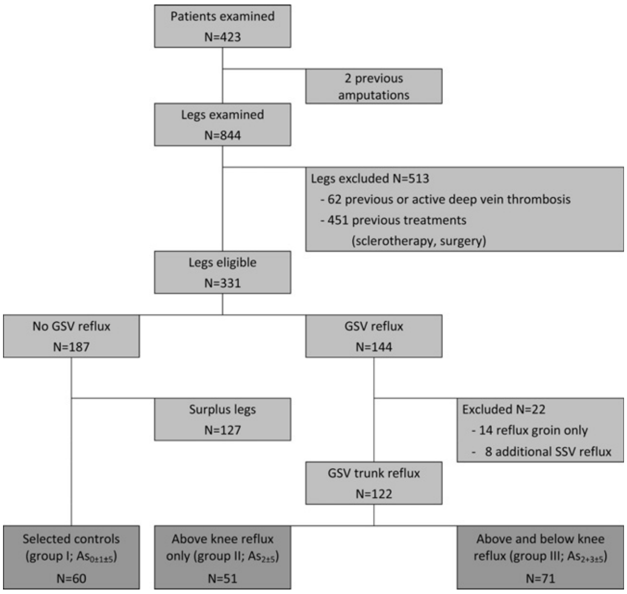

Figure 1. Study flow chart

The conversion factor was applied to published data. Selection of studies was begun with a systematic literature search in Medline, gathering studies on the treatment of GSV insufficiency with stripping, endoluminal ablation by laser or radiofrequency, foam sclerotherapy, CHIVA or incompetent sAphenouS Vein preservAtion with phLebectomy (ASVAL) published between 2000 and 2010. Eligible studies had to state inclusion and exclusion criteria similar to the ones used in this survey and to provide pre-interventional data on reflux and GSV diameters measured at the SFJ or at the PT in a standing position. Studies applying diameter limits for inclusion were excluded. Studies that presented pre-interventional data on various occasions were included only once. Authors were contacted for clarification if this was not clear from the publication. The factor was used to mutually convert data obtained at either point in order to make the studies comparable.

RESULTS

We screened 844 legs and included 182 legs in the survey (Fig. 1). Sixty legs with no GSV reflux and no exclusion criteria served as controls (group I, $As_{0 \pm 1 \pm 5}$, Pr). Truncal GSV reflux was found in 122 legs. Reflux was limited to the thigh in 51 legs (above knee reflux, group II, As, $Pr_{2 \pm 5}$) and extended to the lower leg in 71 legs (above and below knee reflux, group III, $As_{2 + 3 \pm 5}$, Pr).

Demography of patients was equal in the three groups with the exception of weight and body mass index (BMI), which was slightly higher in patients of group II compared to group III (Table 1).

Clinical findings of a venous disorder were absent (C0) in 45% of patients in group I. Teleangiectases (C1) were found in 22%, branch varices (C2) in 12% and oedema (C3) in 22%, the latter associated with branch varices and/or obesity and lipoedema. In groups II and III, absence of any sign of a venous disorder (C0) was found in 3% and teleangiectasis only (C1) was observed in 12%. Branch varices (C2) were found in 46%, oedema (C3) in 25% and skin changes (C4–5) in 15%.

Venous function tests were normal in legs with no GSV reflux (group I): muscle pump function 3.6% (±2.5) and refilling time 29.0 s (±13.0). In patients with GSV reflux (groups II and III), muscle pump function was normal (4.1 ± 2.4%). Refilling time was slightly shortened to 23.9 s (±11.6) as compared with group I ($p < 0.05$).

GSV diameters in all groups, measured at both sites, were not related with patients' age and sex or calf muscle-pump function. Modest correlations were found with body weight in each group (Pearson's $r = 0.30$–0.44, $p < 0.01$) and BMI (Pearson's $r = 0.25$–0.38, $p < 0.01$) but not with height.

Table 1. Patient characteristics and venous disease classification.

	Entire cohort		GSV reflux absent		GSV reflux present				Differences	
			Group I, $As_{0\pm1\pm5}$		Group II, $As_{2\pm5}$		Group III, $As_{2+3\pm5}$			
	N or mean	% or SD	N or mean	% or SD	N or mean	% or SD	N or mean	% or SD	X^2 or F	P
N (legs)	182		60		51		71			
Female	116	64%	35	58%	33	65%	48	68%	1.24	0.538
Age	56	±15	56	±15	56	±13.5	55	±15	0.59	0.943
Height	170	±9	172	±9	170	±9.9	169	±9	2.12	0.123
Weight	82	±20	83	±20	87	±21.0	79	±18	2.37	0.097[a]
BMI	28.3	±6.1	27.8	±6.3	30.0	±6.8	27.5	±5	2.92	0.057[b]
C0	29	16%	27	45%	0	–	2	3%	75.08	<0.001
C1	28	15%	13	22%	6	12%	9	13%		
C2	63	35%	7	12%	25	49%	31	44%		
C3	44	24%	13	22%	12	24%	19	27%		
C4a	12	7%	0	–	5	10%	7	10%		
C4b	5	3%	0	–	3	6%	2	3%		
C5	1	1%	0	–	0	–	1	1%		
Venous pump function (%)	4.0	±2.4	3.6	±2.5	4.0	±2.2	4.2	±2.5	0.82	0.440
Refilling time (sec)	26	±12	29	±13	23	±10	25	±12	4.00	0.020[c]

[a] Group II > III; $p = 0.031$.
[b] Group II > III; $p = 0.023$.
[c] Group I > II + III; $p = 0.009$.

Significant correlations were found with clinical disease classes for the whole sample (Pearson's $r = 0.46-0.54$; $p < 0.001$) and for legs with reflux alone (Pearson's $r = 0.39-0.42$, $p < 0.001$). GSV diameter and refilling time correlated with reflux (Pearson's $r = 0.25-0.28$, $p < 0.01$).

GSV diameters in controls (group I) measured 7.5 mm (±1.8) at the SFJ and 3.7 mm (±0.9) at the PT (Table 2). In patients with GSV reflux (groups II and III), they measured 10.9 mm (±3.9) at the SFJ and 6.3 mm (±1.9) at the PT, respectively. Vein diameters were larger in the presence of reflux, compared with its absence, by an average of 3.4 mm at the SFJ ($p < 0.001$) and 2.6 mm at the PT ($p < 0.001$). No difference in diameters was found between group II (10.5 mm ± 3.2 at the SFJ and 6.2 mm ± 1.7 at the PT) and group III (11.2 mm ± 4.3 at the SFJ and 5.9 mm ± 2.1 at the PT, see Table 2). Thus, the degree of vein dilatation was independent of the length of reflux above knee only versus above and below knee.

GSV diameters were assessed with regard to their value to predict reflux and clinical disease class (Table 3 and Fig. 2). The proportion of vein diameters smaller than the mean values of group I patients and of those positioned above the 2 SD margins were calculated.

A GSV diameter above the 2 SD margin of group I legs was found in 2% in group I at either point of measurement. In groups II and III, a significantly different prevalence was observed when measurements made at the SFJ and PT, respectively. The 2 SD margin was exceeded by 43% of patients when measured at the SFJ and by 62% when measured at the PT. Sensitivity and specificity are calculated for thresholds at the mean, 1 SD and 2 SD above the mean diameters of the control group.

Clinical disease class was also better predicted by diameter assessment at the PT than the SFJ level. Of legs with C_{0-1}, 2% exceeded the 2 SD margins at the SFJ and 4% at the PT. Of legs with C_{2-5}, 49% exceeded the limit when diameters were measured at the SFJ and 59% when measured at the PT.

AUROC curves were used to assess the relative performance of the two sites of measurement (Fig. 3). The areas under the curve for the prediction of GSV reflux were significantly larger when measured at the PT (SFJ: AUROC = 0.786, 95% CI = 0.064; femoral AUROC = 0.907, 95% CI = 0.041). The difference was not significant for the prediction of C-class 2–5 (SFJ: AUROC = 0.782, 95% CI = 0.065; femoral AUROC = 0.839, 95% CI = 0.056).

A GSV diameter of <7.5 mm at the SFJ was associated with reflux in 20%, C_{2-5} disease in 21% and the combined elements in 15%, respectively. A PT diameter of <3.7 mm was associated with reflux in 3%, C_{2-5} disease in 9% and the combined elements in 2%.

Based on linear regression analysis, a mathematical formula was developed to mutually convert measurements taken at the SFJ and the PT. The correlation factors were Pearson's $r = 0.44$ for legs in group I and $r = 0.77$ for legs in groups II and III. Thus, we limited calculations to groups II and III. The formulae are shown in the frame.

Conversion PT to SFJ (95%CI 1.698–1.836):diameter SFJ (mm) = 1.767 × diameter PT (mm)

Conversion SFJ to PT (95% CI 0.544–0.588):diameter PT (mm) = 0.566 × diameter SFJ (mm)

The conversion factors were applied to published data (Table 4). The literature search had identified 32 studies providing pre-treatment data on GSV diameters assessed in patients evaluated for the treatment of varicose disease of the GSV. Eight publications, including 1.856 patients, fulfilled our predefined requirements. Two trials presented a single patient group and six trials compared surgical techniques with two patient groups, which allowed evaluating 14 cohorts. In six trials (10 cohorts) including 1268 patients diameters were measured at the SFJ[16–21]. In two studies (four cohorts) including 588 patients measurements were taken at the PT.[12,13] As compared with our patients with reflux, average GSV diameters were smaller in eight and larger in six cohorts. In six cohorts, the average diameter was below the 1SD margin of our patients with reflux and in one cohort it was in the range of our control population.

DISCUSSION

Comparison of treatment modalities requires exact documentation of the clinical, anatomical and functional situation in each patient using standardised and validated techniques. However, even the recommendations of the Union Internationale de Phlébologie (UIP)[10] regarding measurement of GSV diameter at different sites lack proper validation. Until now no effort was undertaken to show if different measurement points correlate with each other

Table 2. GSV diameters measured at the SFJ and PT as a function of the presence and extent of reflux.

	N	SFJ diameter	PT diameter	Pearson r	P
Group I (no GSV reflux)	60	7.5 mm ± 1.8	3.7 mm ± 0.9	0.44	<0.001
Groups II & III (GSV reflux)	122	10.9 mm ± 3.9	6.3 mm ± 1.9	0.77	<0.001
Difference between groups I and II & III		$T = 6.4$ $p < 0.001$	$T = 9.9$ $p < 0.001$		
Group II (thigh reflux only)	51	10.5 mm ± 3.2	6.2 mm ± 1.7	0.81	<0.001
Group III (lower leg reflux)	71	11.2 mm ± 4.3	6.3 mm ± 2.1	0.75	<0.001
Difference between groups II and III		$T = 0.9$ $p = 0.347$	$T = 0.5$ $p = 0.593$		

Table 3. Sensitivity and specificity for reflux and clinical disease class of sites of diameter measurement. Percentage of diameters below and above mean, mean + 1SD, and mean + 2SD of the GSV diameters measured at the SFJ and PT in group I. Specificity and sensitivity between the absence (group I) and presence of reflux (group II & III legs), and no or minor (C0-1) and important (C2-5) venous disease.

GSV reflux		Diameter at SFJ					Diameter at PT				
		No ($n = 60$)	Yes ($n = 122$)	Specificity	Sensitivity	Predicted correctly	No ($n = 60$)	Yes ($n = 122$)	Specificity	Sensitivity	Predicted correctly
Mean[a]	Below	50.0%	19.7%	0.556	0.766	0.703	51.7%	3.3%	0.886	0.803	0.819
	Above	50.0%	80.3%				48.3%	96.7%			
Mean[b] + 1SD	Below	85.0%	39.3%	0.515	0.892	0.687	81.7%	19.7%	0.671	0.899	0.808
	Above	15.0%	60.7%				18.3%	80.3%			
Mean[c] + 2SD	Below	98.3%	57.4%	0.457	0.981	0.610	98.3%	38.5%	0.557	0.987	0.736
	Above	1.7%	42.6%				1.7%	61.5%			
CEAP C		0–1 ($n = 57$)	2–5 ($n = 125$)				0–1 ($n = 57$)	2–5 ($n = 125$)			
Mean[a]	Below	49.1%	20.8%	0.519	0.773	0.698	42.1%	8.8%	0.686	0.776	0.758
	Above	50.9%	79.2%				57.9%	91.2%			
Mean[b] + 1SD	Below	86.0%	40.0%	0.495	0.904	0.681	73.7%	24.8%	0.575	0.862	0.747
	Above	14.0%	60.0%				26.3%	75.2%			
Mean[c] + 2SD	Below	98.2%	58.4%	0.434	0.981	0.593	96.5%	40.8%	0.519	0.974	0.709
	Above	1.8%	41.6%				3.5%	59.2%			

[a] Mean diameter of the control group (SFJ 7.54 mm, PT 3.66 mm).
[b] Mean diameter + 1 SD of the control group (SFJ 9.36 mm, PT 4.58 mm).
[c] Mean diameter + 2SD of the control group (SFJ 11.18 mm, PT 5.50 mm).

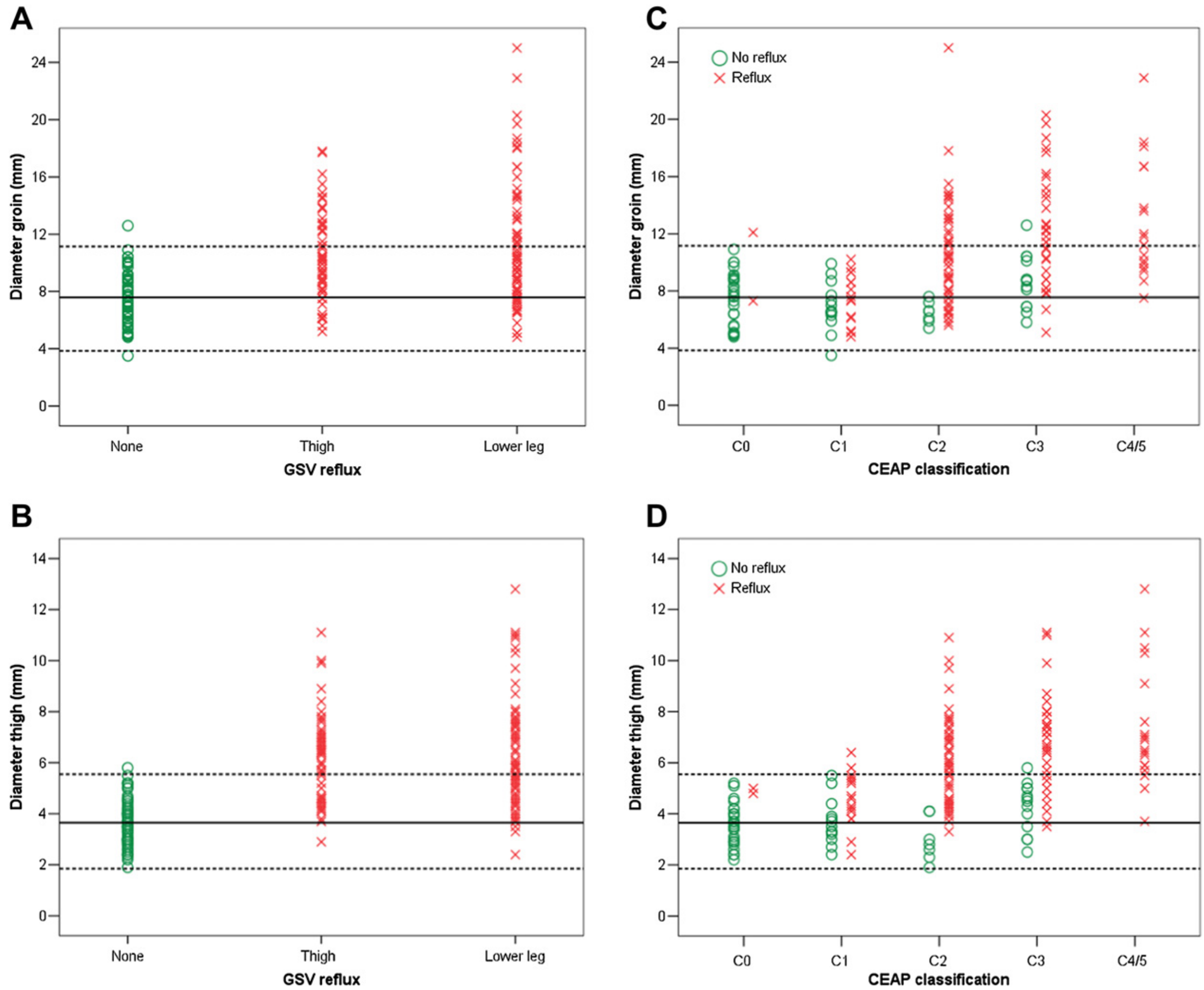

Figure 2. GSV diameters (mm) measured at the SFJ (Panels A and C) and the PT (Panels B and D) as related to the presence of reflux (Panels A and C) and clinical class (Panels B and D). Data were gathered from healthy controls and patients with above and above and below knee reflux. The reference lines denote the mean ±2 SD of values found in controls.

and whether one or the other site allows better prediction of the clinical situation.

We took measurements at the SFJ as proposed by the UIP and compared it with measurements at the PT as used and published by the CHIVA group because no data on the mid-thigh point have been published until 2010.

Diameter measurement at the PT seems to have some advantages as compared with measurement at the SFJ,

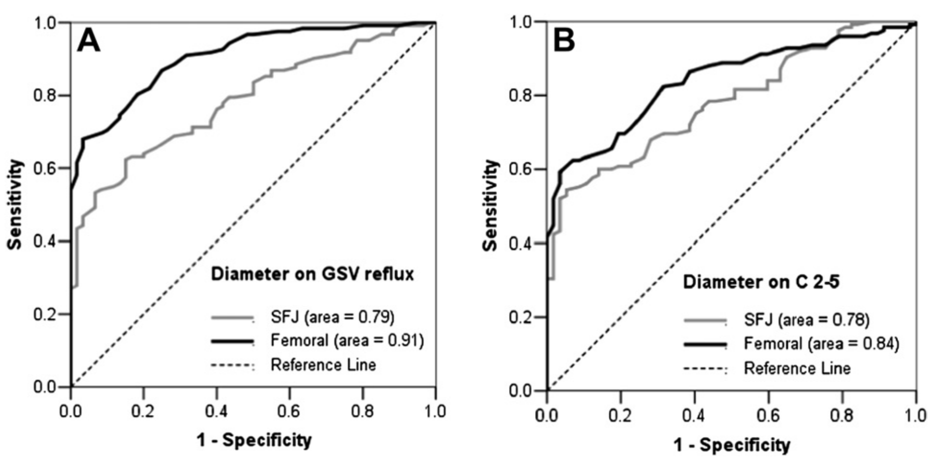

Figure 3. Area under the receiver operator characteristic (AUROC) curves to ascertain the accuracy of GSV diameter measurement at the SFJ and PT, respectively with regard to the presence of GSV reflux (Panel A) and C-classes 2–5 (Panel B) by.

Table 4. Literature derived pre-interventional GSV diameters measured at one of the sites studied in this survey and converted to the other site. Data are sorted according to diameter size; calculated data are in italics.

Author treatment investigated	*N*	Site of measurement	SFJ diameter	Direction of conversion	PT diameter
Pittaluga, P ASVAL[16]	303	SFJ	7.1 ± 0.2	→	*4.0 ± 0.4*
Gonzalez-Zeh Foam[17]	53	SFJ	7.6 ± 3.0	→	*4.3 ± 1.7*
Theivacoumar LASER[18]	84	SFJ	7.7 ± 2.0	→	*4.4 ± 1.1*
Theivacoumar LASER[18]	27	SFJ	7.9 ± 1.6	→	*4.5 ± 0.9*
Gonzalez-Zeh LASER[17]	45	SFJ	8.2 ± 3.2	→	*4.6 ± 1.8*
Pittaluga, P HLS[16]	270	SFJ	8.4 ± 0.3	→	*4.8 ± 0.5*
Creton Closure Fast[19]	295	SFJ	8.4 ± 2.3	→	*4.8 ± 1.3*
Pannier LASER[20]	85	SFJ	10.0 ± 0.4	→	*5.7 ± 0.2*
This study	122	SFJ & PT	10.9 ± 3.9	← →	6.3 ± 1.9
Parés Stripping[12]	167	PT	*11.5 ± 1.1*	←	6.5 ± 1.9
Cappelli CHIVA[13]	177	PT	11.7 ± 1.0	←	6.7 ± 1.7
Doganci LASER[21]	54	SFJ	11.8 ± 4.1	←	*6.7 ± 7.3*
Parés CHIVA[12]	167	PT	*12.0 ± 1.1*	←	6.8 ± 2.0
Doganci LASER[21]	52	SFJ	12.1 ± 4.3	←	*6.8 ± 7.6*
Cappelli CHIVA[13]	77	PT	*12.4 ± 1.1*	←	7.1 ± 2.0

which is a landmark easily identified with ultrasound. While GSV reflux in the groin is readily identified measurement of vein diameter right there is challenging for several reasons. The curvature of the inguinal GSV renders adjustment of the ultrasound probe exactly perpendicular to the vein axis difficult. Further, the shape of the vein is influenced by joining epigastric, pudendal and accessory veins and eventual aneurysmatic dilatations caused by deep venous refluxes. Thus, diameter assessment in the groin appears less reliable.

The PT site 15 cm below the SFJ is located in the truncal portion of GSV where the vein is cylindrical and largely devoid of joining branches. The site is also well accessible and diameter measurements can be taken reliably.

In our experience, nearly a third of patients with reflux in GSV limited to above knee have a sufficient GSV at mid thigh, because the refluxing branch has left the GSV more proximally. Thus, the diameter of the refluxing part of the GSV would be missed if measurements were taken at mid thigh.

The CHIVA Group measures diameters 15 cm distal to the SFJ[12,13] because the PT site allows outcome assessment, as their treatment strategy leaves the GSV trunk *in situ* even when crossectomy is performed.

A further advantage emerges from our data. Measurement at the PT as compared to measurement at the SFJ demonstrated higher accuracy and both higher sensitivity and specificity for venous disease class as well as for prediction of reflux (Table 3). Thus, diameter measurement at the PT may develop as a surrogate parameter for specific clinical situations.

Our data revealed a debatable finding: GSV diameter, venous haemodynamics (refilling times in photoplethysmography (PPG)) and clinical disease class did not differ whether reflux was above knee only or above and below knee. The finding is in disagreement with the understanding that the length of reflux in the GSV would have an influence on disease severity.[18,22,23]

The correlation between the two measurement sites permitted calculation of a conversion factor used to review selected publications. It disclosed a wide range of diameters in patients worked up for interventions with different techniques (Table 4). The data suggest that some studies included patients with minor disease. The same may be true for a recent study that found no correlation between GSV diameter and quality of life.[24] The reported diameters were within the limits of the control subjects of this study.

Diameter assessment at the PT seems suitable for stratification of patients allocated to future interventional trials as well as for outcome evaluation. With more data available it may also become an argument in the discussion of treatment options with patients, which is not the case at the moment.

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CONFLICT OF INTEREST

None.

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