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Association between Anatomical measurements of superficial vein of leg and its correlation with Venous Clinical Severity Score in the Varicose Vein subject: A Cross sectional study.

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Abstract:

Background:

The degree of venous disease was independently determined using a number of common vein assessment methods. The aim of this study to correlate the **Venous Clinical Severity Score** components and correlation with superficial vein in subject of varicose vein.

Methods:

A total of 207 consecutive subject with primary symptomatic who was attened in OPD for varicose vein on 200 legs. It was included in this study. Age, sex, anthropometry, and duplex Doppler USG were performed in the standing position. The diameter of the great saphenous vein, anterior and posterior accessory great saphenous veins, perforator vein, great saphenous vein, anatomic course of the great saphenous vein, and Short Saphenous Vein were documented.

Results:

Mean age (years), HIP (cm), WAIST (cm), and BMI (kg/m2) were 35.21±9.47, 114.05±100.51, 101.56±11.89, 29.35±4.96 in the mild **Venous Clinical Severity Score(**VCSS) group and 36.04±10.32, 192.01±908.60, 102.08±10.31, and 29.39±8.42 in the moderate **Venous Clinical Severity Score** group. The change in Great Saphenous Vein diameter at the level of lower calf was significantly positive, and Short Saphenous Vein (SSV) diameter at midcalf was significantly negatively correlated with **Venous Clinical Severity** Score severity. In contrast, the change in diameter just below the Sapheno-Femoral Junction, Great Saphenous Vein diameter at the thigh, diameter at the mid-thigh, Great Saphenous Vein diameter above the knee, Great Saphenous Vein diameter below the knee, Great Saphenous Vein diameter at the medial malleolus, Short Saphenous Vein diameter at the

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lateral malleolus, and Short Saphenous Vein (SSV) diameter just below the knee were not significantly correlated with the severity of **Venous Clinical Severity Score**.

Conclusion

The GSV diameter at the level of lower calf was significantly positive, and SSV diameter at midcalf was significantly negatively correlated with venous clinical severity score VCS Score severity.

Keywords: Anatomy; Lower extremity; Ultrasonography; Vein, Chronic venous insufficiency, venous clinical severity score (VCS Score) Short Saphenous Vein (SSV) Great Saphenous Vein(GSV) Sapheno-Femoral Junction(SFJ), Chronic venous insufficiency (CVI), chronic venous disease (CVD), venous segmental disease score (VSDS), Venous Disability Score (VDS).

Introduction:

Because of the lack of understanding of the scope and importance of the issue and the numerous manifestations of primary and secondary venous disease, chronic venous disease (CVD) is often not recognised by healthcare providers. The prevalence of CVD and the socio-economic impact of its more severe symptoms are directly related to the relevance of the disease. In the United States, more than 25 million people suffer from varicose veins and more than 6 million from more severe venous disease, making CVD a very common problem [1]. The clinical spectrum of chronic venous insufficiency (CVI) of the lower extremities ranges from asymptomatic but aesthetic problems to severe symptoms [2-5]. Spider veins, reticular veins, varicose veins, edema, pigmentation, eczema, lipo-dermatosclerosis, atrophie blanche, and venous ulceration are among the conditions included.

Chronic venous insufficiency (CVI) results from poor function of the venous walls and/or valves in the veins of the lower limbs, leading to excessive pooling of blood and venous hypertension. Reflux from the deep venous compartment to the superficial venous compartment is triggered by venous hypertension [6]. 9.4% of men and 6.6% of women have CVI [7]. Clinical symptoms include malaise, ankle edema usually occurring in the evening, acute or subacute dermatitis, etc. Long-term persistent venous hypertension can lead to lipo-dermatosclerosis, induration, varicosity, leg ulcers, atrophie blanche, and purpuric or brown spots (caused by hemosiderin deposition). Congestive ulcers occur in an average of 1 to 2.7% of CVI subject [8].

The American Venous Forum, at its sixth annual meeting in 1994, created the Clinical, Etiologic, Anatomic, and Pathologic Classification (CEAP) to standardise the many clinical manifestations of CVI [9]. It is not able to assess the severity of disease. The Venous Clinical Severity Score (VCS Score) and the Venous Disability Score (VDS) were proposed by an ad hoc committee of the American Venous Forum on Venous Outcome Assessment in March 2000 [10]. The VCS Score is a dynamic scoring system capable of reflecting changes after therapy over a short period of time (months) and avoiding static components of CEAP classification. This scoring system showed acceptable interobserver and intra observer variability and was trustworthy [11].

The proposed system consists of three elements: the venous clinical severity score (VCS Score), which is a modification of the CEAP clinical score; the venous segmental disease score (VSDS), which is a combination of the Anatomical and pathophysiologic components of CEAP; and the venous disability score (VDS), a modification of the original CEAP disability score. It is anticipated that these three components can be used

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together as an integrated and improved method for assessing venous outcome [12]. The purpose of the present study is to validate VCS Score components and their different anatomy of varicose veins.

Materials and Methods:

A total of 207 consecutive subject with primary symptomatic varicose vein subject. who underwent superficial vein surgery on 200 legs participated in this prospective, non-randomized study. All subject gave informed consent. After exclusion of 7 subject who were not available for follow-up because both had moved out of the region.

All adult subject with symptoms of chronic venous disease (C2-C6 only) presenting to the OPD of the Department of General Surgery at Index Medical College, Indore, MP and King George's Medical College (KGMU), Lucknow, UP, were included in the study. Subject with C0-C1, age less than 14 and more than 75 years, pregnancy, pelvic tumors, deep vein thrombosis (DVT), and congenital varicose veins were excluded from the study. Each subject was evaluated preoperatively using a clinical examination and questionnaire. According to the revised 2020 CEAP classification, chronic venous disease was be divided into seven clinical classes C0 to C6 with specific signs:

C- clinical

C0: No visible or palpable signs of venous disease

C1: Telangiectasis (spider veins) or reticular veins (<1mm intradermal,

1-3mm sub-dermal venules.)

C2: Varicose veins

C2r: recurrent varicose vein

C3: Edema

C4: Skin changes (pigmentation, eczema and induration)

C4a:Pigmentation or eczema

C4b:Lipodermatoscalerosis or atrophie blanche

C4c: Corona phlebectatica

C5: Healed venous ulcer

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C6: Active open venous ulcer

C6r: Recurrent active venous ulcer

All enrolled subject were documented on the basis of following

The age, sex, anthropometric, Duplex Doppler USG were performed on standing position and following parameters were documented (Fig.1, Fig. 2).

- Diameter of great saphenous vein just below to sapheno- femoral junction.
- Diameter of the great saphenous vein in the proximal, middle, above knee, below knee joint, on the standing position.
- Diameter of anterior accessory saphenous vein, post accessory saphenous vein if present (Just below to junction with GSV).
- Diameter of perforator vein.
- Intersaphenous vein if present and its detail.
- Anatomical course of GSV, SSV.
- Any anomalies of GSV, SSV.
- Severity of enrolled subject was categorized on VCSS.

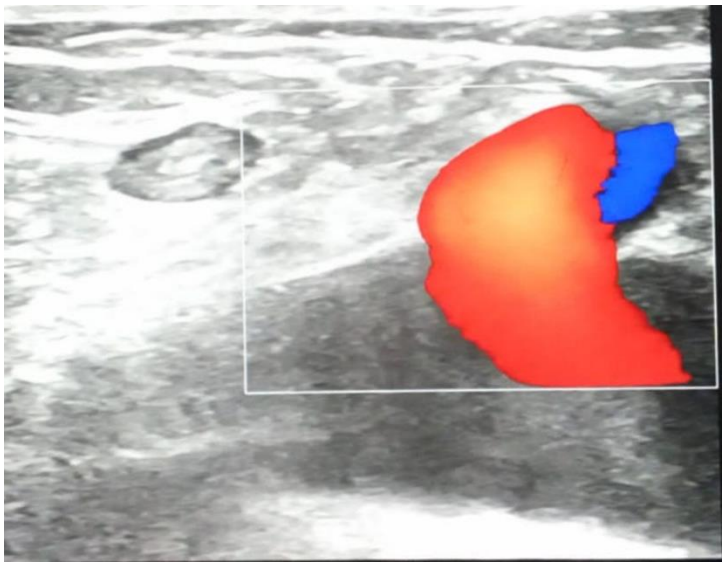

Fig. 1: Duplex doppler USG showing reflux at SFJ

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Fig. 2: Healed venous ulcer (C5)

Statistical analysis:

SPSS version 21.0 was used for statistical analysis. Data were expressed as mean (standard deviation) and percentage (%). The chi-square test was used to compare categorical variables, and the independent t test was used to compare discrete variables between groups. Pearson correlation was used find out the Correlation of VCSS with different anatomical findings of varicose vein. The p value 0.05 was considered significant.

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Results:

The frequencies of age groups ≤20 years, 21-30 years, 31-40 years, 41-50 years, 51-60 years, and > 60 years were 5.50%, 30.50%, 42.00%, 15.00%, 5.50%, and 1.50%, respectively. In addition, most subject (78.0%) were ≤40 years of age. Of the 200 subject, a total of 82% were male and 18% were female. The percentages of professional, student, business, alumni, labourer, housewife, street vendor, tailor, clerk, hotel employee, driver, and other occupations were 24.50%, 13.50%, 10.00%, 9.00%, 14.00%, 11.50%, 5.00%, 2.00%, 7.00%, 1.00%, 0.50%, and 2.00%, respectively (Table 1). The mean VCSS was 10.40±2.54.

Table 1: Distribution of subject according to different age groups

		N	%
Age	≤20 years	11	5.50
	21-30 years	61	30.50
	31-40 years	84	42.00
	41-50 years	30	15.00
	51-60 years	11	5.50
	>60 years	3	1.50
Gender	Male	164	82.00
	Female	36	18.00
Occupation	Job	49	24.50
	Students	27	13.50
	Business	20	10.00
	Former	18	9.00
	Labour	28	14.00
	House wife	23	11.50
	Street vendor	10	5.00
	Tailor	4	2.00
	Worker	14	7.00
	Hotel worker	2	1.00
	Driver	1	0.50
	Other	4	2.00
VCSS	≤10	95	47.50
	>10	105	52.50
	Mean±SD	10.40±2.54	

The mean age (years), HIP (cm), WAIST (cm), and BMI (kg/m2) were 35.21±9.47, 114.05±100.51, 101.56±11.89, 29.35±4.96 in the mild and 36.04±10.32, 192.01±908.60, 102.08±10.31, and 29.39±8.42 in the moderate VCSS group, respectively. Mean age (years), HIP (cm), WAIST (cm), and BMI (kg/m2) did not differ significantly between mild and moderate VCSS (Table 2).

Table 2: Association of anthropometric data of subject in between mild and moderate VCSS

	Mild (n=95)		**Moderate (n=105)**		**t**	**p-Value**
	Mean	**±SD**	**Mean**	**±SD**		
Age (years)	35.21	9.47	36.04	10.32	-0.585	0.559
HIP (cm)	114.05	100.51	192.01	908.60	-0.831	0.407
WAIST (cm)	101.56	11.89	102.08	10.31	-0.331	0.741
BMI (kg/m^2)	29.35	4.96	29.39	8.42	-0.035	0.972

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The mean diameter (mm) just below the SFJ, GSV diameter of the thigh, GSV diameter at mid-thigh, GSV diameter above the knee, GSV diameter below the knee, GSV diameter at med. malleolus, SSV diameter at lateral malleolus, and SSV diameter just below the knee were not significantly different in between mild and moderate VCSS. The mean GSV diameter at mid calf was significantly more in moderate as compared to mild VCSS (Table 3).

Table 3: Association of baseline characteristic with mild and moderate VCSS

	Mild (n=95)		Moderate (n=105)		t	p-Value
	Mean	±SD	Mean	±SD		
Diameter just below SFJ (mm)	9.01	2.04	9.17	2.05	0.919	0.586
GSV diameter of upper thigh (mm)	8.00	1.91	8.18	2.02	0.649	0.524
GSV diameter at mid-thigh (mm)	7.05	1.84	7.20	2.02	0.397	0.586
GSV diameter above knee (mm)	6.18	1.79	6.37	1.97	0.434	0.472
GSV diameter below knee (mm)	6.76	1.80	6.85	1.74	0.894	0.734
GSV diameter at the level of lower calf (mm)	6.33	1.92	6.86	1.82	0.686	0.045
GSV diameter at Med. Malleolus (mm)	4.82	4.44	4.76	3.86	0.905	0.920
SSV diameter at Lateral Malleolus (mm)	3.65	0.83	4.03	3.86	0.077	0.352
SSV diameter mid-calf (mm)	4.02	3.62	4.88	7.29	0.065	0.307
SSV diameter Just below knee (mm)	4.00	0.80	3.87	0.71	0.605	0.246

The change in GSV diameter at the mid-thigh was significantly positively and SSV diameter at midcalf was significantly negatively correlated with the severity of VCSS. Whereas, the change in diameter just below the SFJ, GSV diameter of the upper thigh, GSV diameter at mid-thigh, GSV diameter above the knee, GSV diameter below the knee, GSV diameter med. malleolus, SSV diameter lateral malleolus, and SSV diameter just below the knee were not significantly correlated with the severity of VCSS (Table 4).

Table 4: Correlation of severity of VCSS with diameter just below SFJ, GSV diameter of upper thigh, GSV diameter at mid-thigh, GSV diameter above knee, GSV diameter below knee, GSV diameter at the level of lower calf, GSV diameter at Med. malleolus, SSV diameter at Lateral malleolus, SSV diameter at Mid-calf and SSV diameter just below knee

	Pearson Correlation	p-Value
Diameter just below SFJ	0.005	0.940
GSV diameter of upper thigh	0.032	0.656
GSV diameter at mid-thigh	0.019	0.793
GSV diameter above knee	-0.007	0.925
GSV diameter below knee	-0.002	0.973
GSV diameter at the level of lower calf	0.176*	0.012
GSV diameter Med. Malleolus	0.012	0.865
SSV diameter Lateral Malleolus	0.080	0.260

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SSV diameter mid-calf	0.063	0.375
SSV diameter Just below knee	-0.180*	0.011

Discussion:

While methods for recording venous outcomes have long existed, recent emphasis has been on clinician-created assessment tools to track clinically defined end goals and changes over time. There are numerous approaches to assessing venous outcomes, but no accepted framework. This is in part due to the varying emphasis of different assessment systems, ranging from relatively static elements in the clinical CEAP to subjective parameters in disease-specific venous disease quality of life assessment tools such as the CIVIQ used in this study or others such as the Aberdeen Varicose Vein Questionnaire [13-15] and the Charing Cross Venous Ulceration Questionnaire to serial venous disease severity assessment tools such as the Venous Insufficiency Epidemiological and Economic Study [16] The use of venous disease severity assessment should allow comparison of outcomes over time and after different treatments for subject groups with similar severity.

The VCSS was designed to objectively assess each subject's response to treatment and its outcomes. This grading system was quantitative rather than qualitative. The VDS was simply an evolution of the CEAP invalidity score. It categorises the degree to which subject can perform routine tasks while receiving compression therapy, limb elevation, or both. It is simple and probably closely related to quality of life [17]. Perrin et al. noted in their study that the VCSS and VDS are relevant, easy to assess, composed of instruments whose measurement varies according to the severity of the disease, and are intended to evaluate the effectiveness of chronic venous disease treatment [18]. Meissner [11] and colleagues evaluated the reproducibility of the VCSS by using the same and different observers to validate it.

In our study, the mean VCSS score was 10.40±2.54. Out of 200, total 95 (47.50%) subject had mild (≤VCSS) and 105 (52.50%) subject had moderate (>10 VCSS). Similarly, a previous study reported that the mean VCSS score was 11 ± 4.96 [19]. In another study, a similar value was also obtained, the mean VCSS was 11.1±6.0 [11], but much higher than the VCSS of other studies [20-23].

In this study, there was no discernible difference between mild and moderate VCSS in terms of mean age (years), hip(cm), waist(cm), and BMI (kg/m2). The population was fairly typical for subject with varicose veins: 79% were women, and the mean age was 45 years. Eighty-seven of the subject were white, two were Asian, one was Hispanic, and one was African-American. There was a wide range of heights, weights, and BMIs represented, ranging from subject who would be considered underweight (BMI, 18 kg/m2) to the grossly obese (BMI, 42 kg/m2). GSV diameters varied widely, from 2.2 to 14.1 mm, with a mean diameter of 6.7 mm (standard deviation [SD], 2.4 mm).

In this study, there was no significant difference between mild and moderate VCSS in terms of mean diameter just below the SFJ, GSV diameter of the upper thigh, GSV diameter at mid-thigh, GSV diameter above the knee, GSV diameter below the knee, GSV diameter at medial malleolus, SSV diameter at lateral malleolus, or SSV diameter just below the knee. Compared with mild VCSS, the median GSV diameter at the level of lower calf was much larger in moderate VCSS.

In our study, the severity of VCSS was strongly associated with the change in GSV diameter at the level of lower calf and the change in SSV diameter at mid-calf. However, there was no significant association between the severity of VCSS and the change in GSV diameter just below the SFJ, GSV diameter at the upper thigh, GSV

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diameter at the mid-thigh, GSV diameter above the knee, GSV diameter below the knee, GSV diameter at the medial malleolus, SSV diameter at the lateral malleolus, or SSV diameter just below the knee.

According to this study, both the change in GSV diameter at the level of lower calf and the change in SSV diameter at the midleg correlated significantly with the severity of VCSS. In contrast, change in diameter just below the SFJ, GSV of the upper thigh, GSV at the midthigh, GSV above the knee, GSV below the knee, GSV diameter at the medial malleolus, SSV diameter at the lateral malleolus, and SSV diameter just below the knee did not significantly correlate with the severity of VCSS. These findings support a recent study by Gibson et al, [24] who described the subject group and found that GSV diameter had no association with subject' QOL scores and only a weak association with VCSS. The association between QOL scores is very high, but the correlation between QOL scores and VCSS is very low. The study by Shepherd et al [25] on the relationship between hemodynamic and anatomic assessments and QOL metrics in the context of venous disease. The Aberdeen Varicose Vein Questionnaire (AVVQ) and the Specific Quality-of-life and Outcome Response Venous (SQOR-V) questionnaire were the QOL assessment tools they studied. According to the authors, the VCSS and anatomic reflux (Venous Segmental Disease Score and venous refill times) did not correlate well with QOL measures, while they showed a modest but statistically significant association with the QOL measures themselves. Although previous studies have shown a correlation between increasing GSV diameter and increasing clinical CEAP class, this correlation does not apply to subject' assessment of how their venous disease affects their quality of life. Consequently, basing reimbursement for vein treatment on something as basic as GSV diameter is arbitrary at best.

Conclusion:

Varicose veins occurred more frequently in the age group of ≥30 years. They were more common in men (82%). The mean VCSS score was 10.40±2.54. Of the 200 subject, a total of 95 (47.50%) had mild (≤VCSS) and 105 (52.50%) had moderate (> 10 VCSS). Mean age (years), HIP (cm), WAIST (cm), and BMI (kg/m2) did not differ significantly between mild and moderate VCSS. The change in GSV diameter at the level of lower calf was significantly positive, and SSV diameter at midcalf was significantly negatively correlated with VCSS severity.

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