The Journal of Teachers Association

ISSN 1019-8555 (Print) & ISSN 2408-8854 (Online)
Frequency: Bi-Annual
DOI: https://doi.org/10.70818/taj.v037i02.0394

OPEN ACCESS

Website: www.tajrmc.com
Email: editor@tajrmc.com
Volume-37 | Issue-2 | Jul-Dec 2024

Average Diameter of the Great Saphenous Vein and Its Role in Predicting Chronic Venous Insufficiency among Bangladeshi Population

SMG Saklayen[1]*, Rusama Nuzhat[2], Wahidul Azad Polash[2], Lulu Marzan Hashi[3], Laila Akter Zahan[4], Nusrat Ghafoor[5]

[1] Associate Professor & Consultant and Head of Department, Department of Vascular Surgery, Ibrahim Cardiac Hospital & Research Institute, Dhaka
[2] Assistant Registrar, Department of Vascular Surgery, Ibrahim Cardiac Hospital & Research Institute, Dhaka
[3] Resident Doctor, Department of Vascular Surgery, Ibrahim Cardiac Hospital & Research Institute, Dhaka
[4] Associate Professor, Department of Vascular Surgery, Ibrahim Cardiac Hospital & Research Institute, Dhaka
[5] Professor and Senior Consultant, Department of Radiology and Imaging, Ibrahim Cardiac Hospital & Research Institute, Dhaka

Abstract: ***Background:*** Chronic venous insufficiency (CVI) of the lower extremities is a common but often overlooked condition with varied clinical presentations. The great saphenous vein (GSV) plays a key role in CVI, and its diameter has been suggested as an indicator of venous reflux. The objective of the study is to evaluate the average diameter of the GSV and its potential in predicting CVI in the Bangladeshi population. ***Materials and Methods:*** A total of 289 patients with varicose vein symptoms were included from the Vascular Surgery Outpatient Department of Ibrahim Cardiac Hospital & Research Institute between August 2018 and November 2024. The GSV diameter was measured using duplex ultrasonography at various segments, with particular focus on the saphenofemoral junction (SFJ). Data was analyzed using statistical package for social science (SPSS) version 25. ***Results:*** The highest proportion of subjects in the older age groups >60 years (25.3%) and 51-60 years (23.9%) and the male population (62.3%) was more predominant than the female population (37.7%). The mean diameter of the GSV in the reflux group was significantly larger (6.31 ± 1.71 mm) compared to the normal group (5.80 ± 1.57 mm, P = 0.036). ROC curve analysis revealed that a GSV diameter cutoff of >5.05 mm had moderate sensitivity (78.0%) and specificity (67.0%) in predicting reflux, with an area under the ROC curve of 0.596 (95% CI: 0.514 – 0.678, P = 0.024). ***Conclusion:*** In conclusion, this study demonstrates that the diameter of the GSV, particularly at certain segments, can be a useful indicator of chronic venous insufficiency. The cutoff value of 5.05 mm for predicting reflux, while statistically significant, shows moderate sensitivity and specificity.

Keywords: Chronic Venous Insufficiency (CVI), Great Saphenous Vein (GSV), Venous Reflux, Duplex Ultrasonography, Saphenofemoral Junction (SFJ).

Original Research Article

Correspondence:
Dr. SMG Saklayen
Associate Professor & Consultant and Head of Department, Department of Vascular Surgery, Ibrahim Cardiac Hospital & Research Institute, Dhaka

How to cite this article:
Saklayen SMG, Nuzhat R, Polash WA, Hashi LM, Zahan LA, Ghafoor N; Average Diameter of the Great Saphenous Vein and Its Role in Predicting Chronic Venous Insufficiency among Bangladeshi Population. Taj 2024;37 (2): 502-507

Article history:
Received: August 01, 2024
Published: December 31, 2024

Article at a glance:

Study Purpose: *The purpose of studying the average diameter of the great saphenous vein (GSV) in Bangladeshi population is to support clinical diagnosis, surgical planning, treatment decisions, and to establish population-specific normal ranges and thresholds for venous diseases, supports research in vascular biology, hemodynamics, and venous disease progression.*

INTRODUCTION

The great saphenous vein (GSV), extending the length of the leg, is crucial for facilitating venous return from the lower limbs. Its anatomical course and accessibility make it a significant structure in both interventions. Chronic venous insufficiency (CVI), a common vascular condition, arises when the venous system fails to return blood efficiently from the lower limbs to the heart, often involving dysfunction of the GSV. An increase in the diameter of the GSV is frequently observed in patients with venous reflux and may serve as an

early indicator of developing CVI. Chronic venous insufficiency (CVI) of the lower extremities encompasses a broad spectrum of clinical symptoms, ranging from mild cosmetic concerns to more severe manifestations.[1-4] These can include varicose veins, reticular veins, spider veins (telangiectasia), edema, pigmentation changes or eczema, lipodermatosclerosis, atrophie blanche, and venous ulcers. Despite being relatively common, CVI is often overlooked by healthcare providers due to a limited understanding of its diverse clinical presentations and the underestimation of its severity and impact. [1,2] The prevalence of CVI varies across different population studies, but abnormal venous flow in the lower extremities is found in up to 50% of individuals.[1-3]

Progressive venous insufficiency in the great saphenous vein (GSV) is a key characteristic of this condition. [5,6] Until recently, small superficial veins, such as tributaries and reticular veins, were thought to be harmless and unaffected. However, recent research using retrograde resin venography has shown that venous incompetence can occur in these smaller veins even without GSV reflux.[6,7] The presence of reflux in these small veins is now recognized as being linked to the clinical severity of venous insufficiency .[5,8] Varicose veins develop as a result of reflux from the deep veins into the superficial venous system, typically caused by incompetence at the Sapheno-femoral junction (SFJ), Sapheno-popliteal junction, and incompetent perforator veins in the leg. While SFJ incompetence is not essential for the formation of varicose veins, its presence exacerbates the condition from a hemodynamic perspective.[9] This study aims to examine the average diameter of the great saphenous vein and its potential role in predicting chronic venous insufficiency (CVI) in the Bangladeshi population.

METHODS

This study included a total of 289 patients with varicose vein symptoms presented at the Vascular Surgery Outpatient Department of Ibrahim Cardiac Hospital & Research Institute, between August 2018, and November 2024. Upon arrival, patients presenting complaints related to peripheral vascular disease underwent a detailed historical intake and a thorough clinical examination. Duplex scanning was used to measure the inner anechoic diameter of the great saphenous vein 2 cm distal to the saphenous femoral junction. The relationship between the diameter of the vein at this point and the presence of clinical symptoms was then analyzed. Initially, patients were treated with four-layer compression stockings and lifestyle modifications for several months. After six months of conservative treatment, those who showed no improvement or whose condition worsened underwent surgical intervention.

RESULTS

The study population shows a wide distribution across different age groups. The largest proportion of subjects is in the >60 years age group (25.3%), followed by the 51-60 years age group (23.9%), 41-50 years (20.8%) and 31-40 years (19.0%) age groups and smallest proportion is in the 17-20 years age group (1.4%) (Table 1).

Table 1: Age distribution of the study subject (n=289)

Age in years	Frequency	Percentage (%)
17-20	4	1.4
21-30	28	9.7
31-40	55	19.0
41-50	60	20.8
51-60	69	23.9
>60	73	25.3

The table presents the distribution of study participants based on sex. Out of a total of 289 patients, 180 were male (62.3%) and 109 were female (37.7%), indicating a higher prevalence of varicose vein symptoms among males in the study population. (Table 2).

Table 2: Sex distribution of the study subject (n=289)

Sex	Frequency	Percentage (%)
Male	180	62.3
Female	109	37.7

The measurements of the great saphenous vein (GSV) diameters at various segments (SFJ, mid-thigh, above knee, below knee, ankle, and calf) showed several significant differences between subjects with reflux and those with normal venous flow. The left SFJ (P = 0.036), right mid-thigh (P = 0.015), left mid-thigh (P = 0.002), right above knee (P = 0.011), left above knee (P = 0.009), and left mid-calf (P = 0.008) all showed statistically significant differences in the GSV diameter between the reflux and normal groups. However, there was no significant difference in the right ankle (P = 0.065), left below knee (P = 0.941), and left ankle (P = 0.818) measurements (Table 3).

Table 3: Values Of Diameters Measured at Different Segments of the Great Saphenous Vein

	Reflex		Normal		P value
	Mean	Standard deviation	Mean	Standard deviation	
Right SFJ (mm)	6.12	1.91	5.95	1.80	0.512
Left SFJ (mm)	6.31	1.71	5.80	1.57	0.036
Right mid-thigh (mm)	4.90	2.04	4.26	1.59	0.015
Left mid-thigh (mm)	4.54	1.51	3.83	1.47	0.002
Right above knee (mm)	4.45	1.69	3.93	1.29	0.011
Left above knee (mm)	4.07	1.77	3.71	1.03	0.009
Right below knee(mm)	4.07	1.77	3.64	1.57	0.061
Left below knee (mm)	4.15	1.58	4.22	8.03	0.941
Right ankle (mm)	3.23	0.90	2.98	0.98	0.065
Left ankle (mm)	3.03	0.89	3.00	0.84	0.818
Right mid-calf (mm)	3.38	1.21	3.12	1.32	0.181
Left mid-calf (mm)	3.35	1.09	2.85	0.93	0.008

The table compares the mean diameter of the great saphenous vein (GSV) between patients with venous reflux and those with normal venous function. The mean GSV diameter was significantly larger in the reflux group (6.31 ± 1.71 mm) compared to the normal group (5.80 ± 1.57 mm), with a mean difference of 0.51 mm. This difference was statistically significant (P = 0.036), suggesting that an increased GSV diameter is associated with venous reflux. (Table 4).

Table 4: Diameter Of the Great Saphenous Vein

	Reflex	Normal	Difference	P value
Great saphenous vein	6.31±1.71	5.80±1.57	0.51	0.036

ROC curve analysis shows that the area under the ROC curve for chronic venous insufficiency in predicting high great saphenous vein 5.05 mm was 0.596(95% CI: 0.514 – 0.678, p<0.024) (Figure 1).

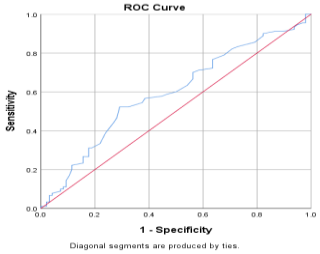

Figure 1: The Receiver Operating Characteristic (ROC) Curve Analysis of Chronic Venous Insufficiency in Predicting Great Saphenous Vein (5.05 Mm).

Area Under the Curve

Area	Std. Error	Asymptotic Sig.	Asymptotic 95% Confidence Interval	
			Lower Bound	Upper Bound
0.596	.042	0.024	0.514	0.678

This table presents the diagnostic performance of the great saphenous vein (GSV) diameter in predicting venous reflux. A cutoff value of >4 mm showed a sensitivity of 78.0% and specificity of 67.0%. The area under the ROC curve (AUC) was 0.590, with a 95% confidence interval ranging from 0.514 to 0.678. These findings indicate that the GSV diameter has moderate diagnostic accuracy in identifying venous reflux. (Table 5).

Table 5: Cutoff Value, Sensitivity and Specificity for Diagnosing Reflux. (A) For The Great Saphenous Vein, 5.05 Mm Was the Best Cutoff Value to Predict Reflux with the Broadest Area Under the Curve.

	Cut of value	Sensitivity	Specificity	Area under the ROC curve	95% Confidence interval (CI)	
					Lower bound	Upper bound
GSV	>4	78.0	67.0	0.590	0.514	0.678

DISCUSSION

The study on the average diameter of the Great Saphenous Vein (GSV) and its potential in predicting chronic venous insufficiency (CVI) among the Bangladeshi population aims to identify a correlation between vein size and the development of CVI. The GSV, a key vessel in venous circulation, is often implicated in the pathophysiology of CVI, with its diameter serving as a potential biomarker for early detection. By examining the average GSV diameter across different demographic groups within Bangladesh, the study seeks to determine whether an increased vein size correlates with a higher risk of CVI, thereby offering insights into preventive measures and early intervention strategies for this prevalent condition in the region. The demographic data in this study reveals a diverse range of participants, with the highest proportion of subjects in the older age groups, particularly those aged >60 years (25.3%) and 51-60 years (23.9%), reflecting the increased prevalence of chronic venous insufficiency (CVI) with age. The male population (62.3%) was more predominant than the female population (37.7%), suggesting a potential gender difference in the distribution of CVI in this sample. This is consistent with previous studies that have shown a higher prevalence of venous insufficiency in men.[5,8,9] Males might be more prone to develop chronic venous insufficiency owing to their nature of occupation and long-standing working hours.[8] Obesity and lack of physical activity were strongly associated with CVI in women, more so than in men. Maximum patients belonged to age groups 21-40 years.

This study shows a significant difference in the diameter of the great saphenous vein (GSV) between individuals with reflux and those with normal venous flow. The mean diameter of the GSV in the reflux group was 6.31 ± 1.71 mm, while in the normal group, it was 5.80 ± 1.57 mm, with a difference of 0.51 mm (P = 0.036). This statistically significant finding suggests that an increased GSV diameter is associated with reflux, making it a potential indicator of chronic venous insufficiency (CVI). These findings are well agreed with other studies .[5,8,9-11] A similar study found the diameter data for the saphenous vein.[12] The mean diameter of a GSV with reflux was 6.4 ± 2.0 mm. This was larger than a normal GSV, which measured 5.0 ± 2.4 mm on average. The diameter difference between the normal and refluxed GSV was 1.4 mm, and statistically significant (P < 0.0001). Going one step ahead to be more definitive, it has been proposed that patients with a GSV diameter of 5.5 mm or less

can be spared for surgery as it indicates a low amount of reflux, whereas those with a diameter of 7.3 mm or more can be considered for surgery indicating significant reflux.[13]

The ROC curve analysis further supports the use of GSV diameter as a predictor for CVI, with an area under the curve (AUC) of 0.596 for a GSV diameter of 5.05 mm. The 95% confidence interval (0.514 – 0.678) and the p-value of 0.024 indicate that the result is statistically significant, though the diagnostic accuracy is modest. When applying a cutoff value of >5.05 mm, the sensitivity of this measurement is 78.0%, meaning it correctly identifies a high proportion of individuals with reflux. However, the specificity is only 67.0%, meaning there is still a relatively high rate of false positives. This suggests that while a larger GSV diameter is associated with reflux, it may not be sufficiently specific to be used as the sole diagnostic criterion for CVI. Various researchers have determined the cutoff diameters of the GSV ranging from 4.5 mm to 6 mm, as predictive of the incompetence of the vein .[8,11,12,15,16] A great saphenous vein (GSV) diameter of 5.5 mm or less was found to predict the absence of abnormal reflux with 78% sensitivity, 87% specificity, and both positive and negative predictive values of 78%, resulting in an overall accuracy of 82% .[13] Conversely, a GSV diameter of 7.3 mm or more was associated with critical reflux, showing 80% sensitivity, 85% specificity, and an accuracy of 84%. Among various thresholds, a GSV diameter of 7 mm or greater was identified as the most reliable predictor of reflux .[17]

The findings of this study suggest that the diameter of the Great Saphenous Vein (GSV) holds promise as a predictive factor for chronic venous insufficiency (CVI). The significant difference in GSV diameters between individuals with reflux and those with normal venous flow supports the notion that an increased GSV diameter is associated with CVI.

Limitations of The Study

This single-center study included only symptomatic patients, limiting generalizability. GSV measurements may vary due to operator dependence, and the diagnostic accuracy of GSV diameter alone was moderate. Larger multicenter studies with additional clinical parameters are needed for validation.

CONCLUSION

This study highlights the role of measuring the great saphenous vein (GSV) diameter in diagnosing chronic venous insufficiency (CVI), particularly for detecting reflux. A GSV diameter cutoff of >5.05mm showed moderate sensitivity and specificity. Significant differences in vain diameter, especially in proximal regions, suggest that these measurements are useful indicators of CVI. However, the diagnostic accuracy of the 5.05 mm threshold remains moderate, and further research combining GSV diameter with other clinical factors could improve CVI diagnosis.

Funding: No funding sources.

Conflict of interest: None declared.

Ethical approval: The study was approved by the Institutional Ethics Committee.

REFERENCE

1. Naser M, Naser MM, Shehata LH. Management of Chronic Venous Insufficiency (CVI) Literature Review. International Journal of Progressive Sciences and Technologies (IJPSAT) 2023;37(No. 2):353-371
2. Eberhardt, Robert T. and Joseph D. Raffetto. Chronic venous insufficiency. Circulation 2014; 130:333-346.
3. Baliyan V, Tajmir S, Hedgire SS, Ganguli S, Prabhakar AM. Lower extremity venous reflux. Cardiovascular diagnosis and therapy. 2016 Dec;6(6):533.
4. Santler B, Goerge T. Chronic venous insufficiency–a review of pathophysiology, diagnosis, and treatment. JDDG: Journal der Deutschen Dermatologischen Gesellschaft. 2017 May;15(5):538-56.
5. Radhakrishnan N, George D, Jayakrishnan R, Sumi S, Kartha CC. Vein size and disease severity in chronic venous diseases. International Journal of Angiology. 2018 Dec;27(04):185-9.
6. Vincent J R, Jones G T, Hill G B, van Rij a M.Failure of microvenous valves in small

superficial veins is a key to the skin changes of venous insufficiency J Vasc Surg 201154(6, Suppl):62S-9S. e1–e3.
7. Lane T RA, Varatharajan L, Fiorentino F et al. Truncal varicose vein diameter and patient-reported outcome measures. Br J Surg. 2017;104(12):1648–1655.
8. Singh M, Singh S, Singh AK, Devan M. Correlation of Great Saphenous Vein Diameter in Development of Reflux and Varicosity. Int. J. Contemp. Med. Surg. Radiol. 2020;5: A224-7.
9. Lahel RS, Chail A, Kumar S. Determination of cutoff diameter of great saphenous vein as indicative of saphenofemoral junction incompetence in cases of varicose veins. J Mar Med Soc 2024; 26:15-8.
10. Mendoza E, Blättler W, Amsler F. Great saphenous vein diameter at the saphenofemoral junction and proximal thigh as parameters of venous disease class. European Journal of Vascular and Endovascular Surgery. 2013 Jan 1;45(1):76-83.
11. el Mallah S, Al-Khateep Y, Hady K. Great saphenous vein diameter at different regions and its relation to reflux. J Med Sci Res 2021; 4:90.
12. Joh JH, Park HC. The cutoff value of saphenous vein diameter to predict reflux. Journal of the Korean Surgical Society. 2013 Oct 1;85(4):169-74.
13. Navarro TP, Delis KT, Ribeiro AP. Clinical and hemodynamic significance of the greater saphenous vein diameter in chronic venous insufficiency. Arch Surg 2002; 137:1233-7.
14. Singh A, Karmacharya R, Vaidya S, Thapa P, Bhatta G. Ultrasound color duplex parameters of patients presenting with lower limb varicose veins at outpatient department of university hospital of Nepal. Indian J Vasc Endovasc Surg 2021; 8:29.
15. Karmacharya RM, Shrestha BK, Shrestha B. Prediction of saphenofemoral junction incompetence by measurement of great saphenous vein size at the level of femoral condyle. Indian J Vasc Endovasc Surg 2018; 5:92.
16. Kim MJ, Park PJ, Koo BH, Lee SG, Byun GY, Lee SR. Association between venous reflux and diameter of great saphenous vein in lower thigh. J Vasc Surg Venous Lymphat Disord 2020; 8:100-5.
17. Engelhorn C, Engelhorn A, Salles-Cunha S, Picheth E, Castro Jr N, Dabul Jr N, et al. Relationship between reflux and greater saphenous vein diameter. J Vasc Technol 1997;21(1):167-71.

The Journal of Teachers Association
Abbreviated Key Title: TAJ
Official Journal of Teachers Association Rajshahi Medical College