EJMI

DOI: 10.14744/ejmi.2020.86291
EJMI 2020;4(4):477–482

Research Article

Relationship Between Clinical Findings and Vena Saphena Magna Diameter and Insufficiency at Cruris

Halime Cevik Cenkeri, Sadik Ahmet Uyanık, Eray Atli, Umut Oguslu

Departments of Radiology, Okan University Faculty of Medicine, Istanbul, Turkey

Abstract

Objectives: The aim of our study is to investigate the relationship between the severity of VSM (vena saphena magna) insufficiency, diameter, and clinical findings, especially at cruris.

Methods: Our study was performed between November 2016 and May 2020, retrospectively with 194 low extremities. VSM diameter measurement and reflux were evaluated at three levels during the examination with Colour Doppler Ultrasonography (CDUS), sapheno-femoral junction(SFJ), midfemoral segment and proximal to the cruris, standing and lying. The patients without venous insufficiency constitute the control group.

Results: The mean VSM diameter is 5.51mm in SFJ, 4.08mm in the thigh and 3.47mm in the cruris. The increase in VSM diameters was statistically significant($p<0.01$) at all of the three levels, compared to control group($p<0.01$). The VSM diameter difference was found to be high in the group with insufficiency in lying position examination especially in the SFJ and thigh level ($p<0.01$). The VSM diameter in the cruris is low but significant($p<0.05$). Correlation between SFJ and cruris is present between diameter increase differences and clinical findings at all of levels. Therefore, in those patients in whom diameter in SFJ, cruris localizations increased in standing position, skin lesions are more frequent ($p<0.01$).

Conclusion: Clinical findings correlate with VSM insufficiency and diameters. The skin lesions correlate with the diameter increase during evaluation in standing position. Diameter change is greater in the SFJ and thigh than significant change at cruris. Finally, the VSM diameter increase in cruris correlates more with skin lesions.

Keywords: Cruris, doppler, diameter, Vena Saphena Magna

Cite This Article: *Cenkeri HC, Uyanık SA, Atli E, Oguslu U. Relationship Between Clinical Findings and Vena Saphena Magna Diameter and Insufficiency at Cruris. EJMI 2020;4(4):477–482.*

Chronic venous insufficiency is a common disease, affecting morbidity and quality of life. In most cases vena saphena magna (VSM) is the target vessel. VSM diameter increase is a typical finding of varicose veins.[1,2] Clinical findings secondary to valve insufficiency, abnormal blood flow, wall tension, and prolonged volumetric burden, appear.[3] Valvular damage due to venous wall degeneration is the most basic characteristic of chronic venous insufficiency. Valsalva maneuver is the most commonly used method for assessing valve function.[4]

Duplex ultrasonography is a repeatable and easily performed method that can assess both anatomy and function.[1] Reflux and VSM diameter are important parameters in evaluation of the severity of the disease and in planning the treatment course.[3] Whereas previously ligation and stripping were used, today, endovenous thermal ablation, foam sclerotherapy, liquid embolizing agents and hemodynamic surgery are preferred in the treatment.[3] Measurement of VSM diameter from 3-cm distal to saphenofemoral junction (SFJ), and mid-thigh[3, 5] or in timely studies, from

Address for correspondence: Halime Cevik Cenkeri, MD. Departments of Radiology, Okan University Faculty of Medicine, 34947 Tuzla, Istanbul, Turkey
Phone: +90 533 225 48 16 **E-mail:** hlm.cvk@hotmail.com

Submitted Date: August 27, 2020 **Accepted Date:** October 07, 2020 **Available Online Date:** October 13, 2020

15 cm distal[3,6,7] to the SFJ, is recommended.

The aim of our study is to investigate the relationship between the severity of VSM insufficiency and diameter, and the clinical findings. During examinations in standing and lying positions; we also investigated the changes in VSM diameter in relation to position. The effect of VSM diameter change on the degree of insufficiency and clinical findings was questioned in cruris, where complaints were more frequent.

Methods

Our study was retrospective and was made in accordance with the Helsinki Declaration of 1964 adopted in 2013. The study was approved by the İstanbul Okan University Ethics Board (Meeting: 11/06/2020 Document number: 56665618-204.01.07). Our study was conducted on 194 legs referred to our department with preliminary diagnosis of venous insufficiency, between November 2016 and May 2020. Cases with an acute complication such as thrombus or phlebitis, VSM duplication and pregnancy were excluded from the study.

All studies were performed by a single radiologist, using GE Logic 7 (General Electric) 9-11 MHz linear probe. All cases waited for 15 minutes in standing position, before the examination. The VSM diameter is affected by the patient's position, intra-abdominal pressure, room temperature and heart disease. For this reason, all studies were carried out in constant room temperature, in the same position, standing and lying. In the study carried out in lying position, augmentation was performed for patency, morphology and valsalva maneuver was performed to evaluate valve function. VSM diameter measurement and reflux were evaluated at three levels, namely at 3 cm distal to SFJ , middle thigh and 3 cm proximal to cruris, in standing and lying examination. Diameter measurements were made on transverse plane and without applying pressure.

The Doppler angle was chosen to be 60 degrees and the sampling area to be appropriate for vessel diameter. While assessing the insufficiency during Doppler examination, reflux longer than 0.5 seconds was considered to be pathological.

For clinical evaluation, the patients were classified according to CEAP (clinical, ethiologic, anatomic and pathophysiologic) system. Depending on this, telangiectasia or reticular veins (C1), varicose dilatations of 3mm or more (C2), edema (C3), pigmentation or eczema (C4a), lipodermosclerosis or atrophic whiteness (C4b), were considered as venous ulcer (C5) and active venous ulcer (C6). Anatomically, only superficial veins and symptoms and pathologically those that are caused by reflux were included in the study.

Statistical Analysis

For statistical evaluations, SPSS (Statistical Package for Social Sciences) version 15.0 for Windows (SPSS Inc., Chicago, IL, USA) was used. Whether the data did not displayed normal distribution according to Kolmogorov-Smirnov and Shapiro-Wilk and whether they can be subjected to non-parametric tests, has been evaluated. Since the data did not show a normal distribution, the Mann Whitney U test was used to compare the diameters of two groups with and without insufficiency. Mann Whitney U test was also used to compare VSM diameters in insufficiency cases with and without SFJ insufficiency, at three levels. The subgroups of insufficiency, diameters at all of the three levels and clinical findings were compared utilising Chi-Square test. Pearson correlation test was used to compare VSM diameter differences in standing and lying positions, with insufficiency and clinical findings. The limit of significance was $p<0.05$ for all tests.

Results

Between November 2016 and May 2020, 194 low extremities of 97 cases examined were included in the study. The control group included 39 patients without venous insufficiency.

In our patient group, there are 37 males and 60 females. The mean age of the patients is 58.7 (24-89) ± SD(15.22) years. There are many studies in the literature, which indicate that the incidence of superficial venous insufficiency is higher in women and that the severity and frequency increase with age.[8-11]

The mean VSM diameter is 5.51±1.41mm in SFJ, 4.08±1.15 mm in the thigh and 3.47±1.12 mm in the cruris (Table 1).

Reticular veins (C1) were detected in %10 of the control group and in %4.9 cases with insufficiency. Varicose veins (C2) were observed in %2.2 of the control group and %6.3 cases with insufficiency. Edema (C3) was present in 27.7 of the control group and %27 cases with insufficiency. Pigmentation (C4a) was monitored in %22.9 of the control group and %67.1 cases with insufficiency.

The patients with venous insufficiency, %24.3 had insufficiency only in SFJ, %22.5 had in the thigh and/or cruris,

Table 1. The average of VSM diameters

	Minimum	Maxiumum	Mean VSM* diameter	±SD
SFJ**	2.70 mm	14.50 mm	5.51 mm	1.41
Thigh	2.00 mm	9.20 mm	4.08 mm	1.15
Cruris	1.70 mm	9.70 mm	3.47± mm	1.12

*VSM: Vena saphena magna; **SFJ: Saphenofemoral junction.

and %53.1 had in all of the three levels. Of the cases with insufficiency at all three levels, %19.8 had Grade 4, %18.4 had Grade 3, %9 had Grade 2, and %5.8 had Grade 1 insufficiency.

In VSM insufficiency cases, VSM diameters increased statistically significantly ($p<0.01$) at all of the three levels (Fig. 1).

When we evaluated the subgroups of insufficiency, the VSM diameters increased statistically significantly ($p<0.01$) as the degree of insufficiency increased from grade 1 to 4, at all of the three levels.

VSM diameters of cases with SFJ insufficiency, were statistically significantly higher ($p<0.01$) than those who were free of SFJ insufficiency in SFJ, thigh and cruris.

Of 194 extremities examined in standing and lying positions, 78 (%40.2) cases with no insufficiency constituted the control group and 116 (%59.8) patients with insufficiency constituted the patient group. In our control group, VSM diameters in lying position were 4.95±0.78 mm in SFJ, 3.63±0.79 mm in the thigh and 2.97±0.61 mm in cruris, while the measurements taken in standing position are 5.62±1.00 mm, 3.77±0.68 mm and 3.13±0.51 mm, respectively. VSM diameters of our patient group were respectively, 5.74±1.61 mm, 4.31±1.28 mm and 3.76±1.34 mm in standing position, while they were 6.95±2.26 mm, 4.83±1.56 mm, and 4.18±1.47 mm in lying position. VSM diameters were observed to increase during the examination conducted in standing position, in the groups with and without insufficiency (Figs. 2, 3). When the diameter

Figure 1. VSM insuffiency at SFJ.

Figure 2. VSM diameter at SFJ in standing position.

Figure 3. VSM diameter at SFJ in lying position.

differences between the two groups were compared, it was seen that the diameter difference was larger in the patient group, especially in the SFJ and thigh level ($p<0.01$) (Fig. 4). In cruris, it was lower, but nonetheless significant ($p<0.05$). There is a correlation in SFJ and cruris, between diameter increase differences and clinical findings, at all of the three levels. However, there was no correlation between diameter increase in thigh and clinical findings. Therefore, varicose veins and skin lesions are seen more frequently in the insufficiency cases, whose VSM diameters increase in standing position in SFJ and cruris.

The varicose dilatations and pigmentation were statistically more significant in the group with insufficiency ($p<0.01$). The varicose dilatations and pigmentation are more frequent as the severity of insufficiency increases compared with clinical findings between subgroups of insufficiency ($p<0.01$).

Discussion

Union Internationale Phelobologie (UIP) recommends that the VSM diameter measurement be made 3 cm distal to SFJ and in the middle of the thigh.[5] But in our study, VSM diameters were also measured at all of the three levels, namely 3 cm distal to SFJ, middle of thigh, and additionally 3 cm proximal to cruris. We also measured the diameter and insufficiency of the VSM at cruris, because there are more skin lesions at cruris.

In our study, the VSM diameters increased in all of the three levels, in the patients with VSM insufficiency, compared to those who are without. In addition, VSM diameter increase

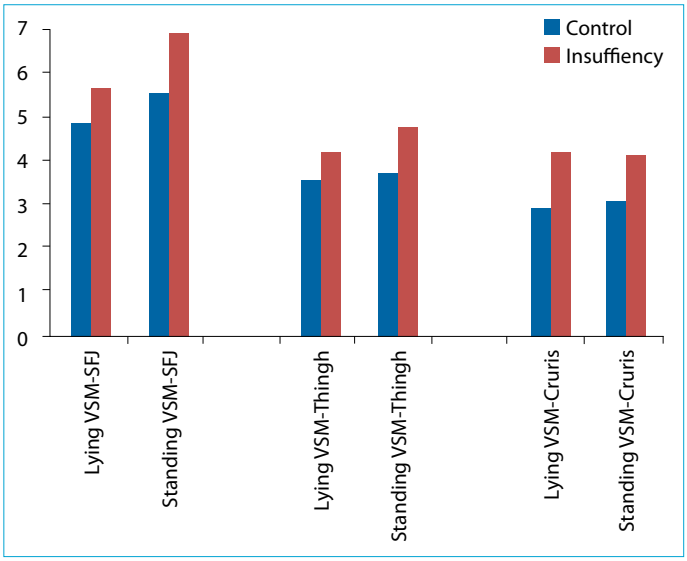

Figure 4 The change of VSM diameters depending on position, in control group and in cases with insufficiency.

*VSM: Vena saphena magna; **SFJ: Saphenofemoral junction.

correlates with the degree of insufficiency. Clinically, varicose veins and skin lesions are more frequent in the group with insufficiency and as the degree of insufficiency increases. These findings suggest that VSM diameter and insufficiency are correlated, and that SFJ function is also an important factor in VSM diameter and insufficiency.

There are similar studies in the literature showing that the measurement of venous diameter correlates with reflux.[1,8,14] In this study, the best diameter threshold value for pathological reflux prognosis was found to be >5.05 mm for VSM.[1]

In the study conducted with a control group, with VSM insufficiency only in the upper leg and with VSM insufficiency both in the upper and lower leg, in which only two levels of diameter were measured in the VSM, the correlation between clinical findings and insufficiency have been found to be more specific and sensitive in measurements performed on mid-thigh, which is at a more distal point, than those at the main femoral venous junction.[3] Therefore, we have included the study of the cruris to study the correlation of VSM insufficiency and diameter changes with clinical findings even further distally.

In the study with SFJ and VSM insufficiency, where diameter measurements at seven levels (proximal, middle, and distal thigh, knee, proximal, middle, and distal cruris) were conducted, venous insufficiency clinic and diameter were found to be in correlation, especially on the thigh and knee. It has been shown with 78% specificity and 87% sensitivity that, when the VSM diameter is <5.5 mm that there will be no pathological reflux.[12] Likewise, in our study, VSM diameter averages were 4.95 mm in SFJ in cases of the control group, while VSM diameter average was 5.74 mm in cases with insufficiency.

However, in another study investigating the relationship between hemodynamically significant reflux and VSM diameter, the sensitivity was 69.7% and the specificity was 64.6% and was found to be weak.[13] This group of patients consists of hemodynamically significant reflux patients and patients with advanced stage insufficiency.

Diameter alone should not be suffient as a criteria in deciding on VSM reflux treatment. The peak flow rate of the reflux current and the average flow rate of the reflux current are helpful in distinguishing between early and advanced superficial venous insufficiency in Konoeda et all.'s study conducted on 2160 legs. SFJ correlates with reflux time, reflux peak flow velocity and reflux mean flow velocity and VSM diameter in the thigh.[15] The distal level of VSM insufficiency is better correlated with clinical findings.

In a study of patients without pathological deep venous insufficiency, the patient's position (standing or lying)

changed the examination results. When valsalva maneuver is applied in supine position, venous diameters and venous capacity increase with intraabdominal pressure. Intraabdominal and hydrostatic pressure increases when a valsalva maneuver is applied in standing position, venous dilatation associated with valsalva is not seen in this position and the duration of reflux is shortened compared to supine position.[4]

Valsalva maneuver mainly affects the main femoral venous, and less commonly the superficial femoral vein and vena saphena magna.[10] This may be related to the large number of valves in these locations. Valve area and number of valves, can cause different vein segments to react differently to valsalva maneuver.

In our study, during examinations in standing and lying positions, it was observed that the differences in diameter were more especially in the SFJ and thigh level, in cases with insufficiency. Diameter differences in cruris are affected less by position. However, in the insufficiency cases in which the diameter increase is more in SFJ and cruris, varicose veins and skin lesions are also observed more frequently. Unlike other studies, it is possible that the increase in the diameter of the standing examination is excessive, due to the fact that the patients were kept standing before the examination. Furthermore, the fact that most of our case group had grade 3 or 4 insufficiency at all three levels, and thus loss of valve function was greater, might have affected the results.

There are many studies in the literature showing that superficial venous insufficiency is important in the development of venous ulcers.[16-20] Different localizations of valsalva maneuver standardization and VSM diameter measurement are being investigated.

The limitation of our study is retrospective. Therefore, the difference intraobserver and interobserver was not evaluated. Inclusion of large age groups and the presence of patients with each degree of insufficiency are the advantages of our study.

Conclusion

In conclusion, our study has found a correlation between clinical findings, insufficiency and VSM diameter, in standing and lying positions. In particular, SFJ insufficiency is important in the development of varicose veins. The differences in diameter were more especially in the SFJ and thigh level, in cases with insufficiency. However, since cruris correlates more with clinical findings, as the degree of insufficiency increases, varicose veins and skin lesions are more frequent. Diameter differences in cruris are affected less by position. It was shown that, evaluation in patients with advanced stage venous insufficiency, contribute to revealing the loss of valve function in proximal, especially in SFJ and thigh localizations.

Disclosures

Ethics Committee Approval: The study was approved by the İstanbul Okan University Ethics Board (Meeting: 11/06/2020 Document number: (56665618-204.01.07).

Peer-review: Externally peer-reviewed.

Conflict of Interest: None declared.

Authorship Contributions: Concept – H.C.Ç.; Design – H.C.Ç.; Supervision – S.A.U., E.A., U.O.; Materials – S.A.U., E.A., U.O.; Data collection &/or processing – S.A.U., E.A., U.O.; Analysis and/or interpretation – S.A.U., E.A., U.O.; Literature search – H.C.Ç.; Writing – H.C.Ç.; Critical review – S.A.U., E.A., U.O.

References

1. Joh JH, Park HC. The cutoff value of saphenous vein diameter to predict reflux. J Korean Surg Soc 2013;85:169–74.
2. Engelhorn C, Engelhorn A, Salles-Cunha S, Picheth E, Castro NJr, Dabul NJr, et al. Relationship between reflux and greater saphenous vein diameter. J Vasc Tecnol 1997;21:167–72.
3. Mendoza E, Blättler W, Amsler F. Great saphenous vein diameter at the saphenofemoral junction and proximal thigh as parameters of venous disease class. Eur J Vasc Endovasc Surg 2013;45:76–83.
4. Jeanneret C, Labs KH, Aschwanden M, Bollinger A, Hoffmann U, Jäger K. Physiological reflux and venous diameter change in the proximal lower limb veins during a standardised Valsalva manoeuvre. Eur J Vasc Endovasc Surg 1999;17:398–403.
5. Coleridge-Smith P, Labropoulos N, Partsch H, Myers K, Nicolaides A, Cavezzi A. Duplex ultrasound investigation of the veins in chronic venous disease of the lower limbs--UIP consensus document. Part I. Basic principles. Eur J Vasc Endovasc Surg 2006;31:83–92.
6. Pares O. Varicose vein surgery: stripping versus the CHİVA method. A randomized controlled trial. Ann Vasc Surg 2010;251:624–31.
7. Cappelli M, Lova RM, Ermini S, Turchi A, Bono G, Bahnini A, et al. Ambulatory conservative hemodynamic management of varicose veins: critical analysis of results at 3 years. Ann Vasc Surg 2000;14:376–84.
8. Gibson K, Meissner M, Wright D. Great saphenous vein diameter does not corelate with worsening quality of life scores in patients with great saphenous vein incompetence. J Vasc Surg 2012;56:1634–41.
9. Kaplan RM, Criqui MH, Denenberg JO, Bergan J, Fronek A. Quality of life in patients with chronic venous disease: San Diego population study. J Vasc Surg 2003;37:1047–53.
10. Carpentier PH, Maricq HR, Biro C, Ponçot-Makinen CO, Franco A. Prevalence, risk factors, and clinical patterns of chronic ve-

nous disorders of lower limbs: a population-based study in France. J Vasc Surg 2004;40:650–9.
11. Sudoł-Szopińska I, Bogdan A, Szopiński T, Panorska AK, Kołodziejczak M. Prevalence of chronic venous disorders among employees working in prolonged sitting and standing postures. Int J Occup Saf Ergon 2011;17:165–73.
12. Navarro TP, Delis KT, Ribeiro AP. Clinical and hemodynamic significance of greater saphenous vein diameter in chronic venous insufficiency. Arch Surg 2002;137:1233–7.
13. Musil D, Herman J, MazuchJ. Width of great sapheous vein lumen in the groin and occuruence of significant reflux in saphenoufemoral junction. Biomed Pap Med Fac Univ Palacky Olomouc Czech Repub 2008;1152:267–70.
14. Lapidus L, Bengtsson C, Hällström T, Björntorp P. Obesity, adipose tissue distribution and health in women--results from a population study in Gothenburg, Sweden. Appetite 1989;13:25–35.
15. Konoeda H, Yamaki T, Hamahata A, Ochi M, Sakurai H. Quantification of superficial venous reflux by duplex ultrasound-role of reflux velocity in the assessment the clinical stage of chronic venous insufficiency. Ann Vasc Dis 2014;7:376–82.
16. Magnusson MB, Nelzén O, Risberg B, Sivertsson R. A Colour Doppler Ultrasound Study of Venous Reflux in Patients with Chronic Leg Ulcers. Eur J Vasc Endovasc Surg 2001;21:353–360.
17. Callam MJ. Epidemiology of varicose veins. Br J Surg 1994;81:167–73.
18. BAUER G. Patho-physiology and treatment of the lower leg stasis syndrome. Angiology 1950;1:1–8.
19. Burnand KG. The aetiology of venous ulcereation. Acta Chir Scand Suppl 1988;544:21–4.
20. Labropoulos N, Leon M, Nicolaides AN, Giannoukas AD, Volteas N, Chan P. Superficial venous insufficiency: correlation of anatomic extent of reflux with clinical symptoms and signs. J Vasc Surg 1994;20:953–8.