

The Cut-off Value of Great Saphenous Vein Diameter at the Level of Femoral Condyle to Predict the Sapheno-Femoral Junction Incompetence

Singh AK,¹ Karmacharya RM,² Vaidya S,² Shrestha I,² Siwakoti S²

¹National Consultant,
WHO, Kathmandu, Nepal.

²Department of Department of General Surgery
(CTVS Unit),
Dhulikhel Hospital, Kathmandu University Hospital,
Dhulikhel, Kavre, Nepal.

Corresponding Author

Amit Kumar Singh
National Consultant,
WHO, Kathmandu, Nepal.
E-mail: amitksingh.nepal@gmail.com

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ABSTRACT

Background

Varicose vein is one of the commonest problems that patients visit to a vascular out patient services (OPD). It causes a great deal of morbidity in today's population.

Objective

To see the correlation between the size of great saphenous and Saphenofemoral junction incompetence.

Method

From January 2019 till January 2020, 396 patients with symptomatic or clinically diagnosed varicose veins were screened for Saphenofemoral junction reflux. The diameter of the saphenous vein was measured with B-mode imaging, and reflux was quantified based on valve closure time using Doppler spectral measurements. Best saphenous vein diameter cutoff for predicting reflux was determined using receiver operating characteristics curve analysis.

Result

Out of 792 limbs, the Great Saphenous Venous System was involved in 452 limbs, the Short Saphenous Venous System was involved in 151 limbs and significant perforators were present in 240 limbs. Mean great Saphenous Vein diameter of diseased limb (Reflux Positive) was 5.68 mm and 4.0 mm in control group (Reflux Negative). Mean Saphenofemoral junction diameter was 8.23 mm in diseased limbs and 6.16 mm in control limbs. Receiver operating characteristics curve showed great saphenous vein diameter at femoral condyle of 4.5 mm as best cut-off value for diagnosis of sapheno femoral junction reflux.

Conclusion

Great Saphenous Vein diameter at femoral condyle of 4.5 mm is the best cut-off value for diagnosis Saphenofemoral junction reflux. The Sensitivity and specificity of this cut off value is 81.8% and 71% respectively.

KEY WORDS

Doppler, Great-saphenous veins, Radio-frequency ablation, Varicose veins

INTRODUCTION

Varicose veins are dilated peripheral veins with reversal of blood flow usually in great saphenous vein due to incompetent valves. The clinical spectrum ranges from asymptomatic to itching, edema, pigmentation and ulceration. 15% of men and 25% of women are affected by this disease condition.¹

Duplex Ultrasound (US) has become the gold standard for the evaluation of varicose veins. A venous duplex examination combines B-mode and color flow imaging. Color flow assesses direction of blood flow and exact location of refluxing valve jets.

Identification of reflux requires Duplex US machines with higher resolution. In resource poor settings like in Nepal, higher resolution doppler devices may not be available. However, great saphenous vein diameter can be measured with simple ultrasonogram (USG) machines.² Hence, this study is done to determine the cutoff value of great saphenous vein (GSV) diameter at the level of femoral condyle that may help ease the difficulty in predicting sapheno-femoral junction incompetence.

METHODS

This is a hospital based, prospective observational study From January 2018 to January 2020, conducted in a University Hospital after getting an ethical approval and patient consent. Three Hundred Ninety-six patients with symptomatic or clinically diagnosed varicose veins during the study period were screened for Saphenofemoral junction reflux. The examination was performed by the lecturer in vascular unit following institutional protocol.

All patients were evaluated by using KALAMED Ultrasound Machine (KUP-211); with a linear probe of 5-12 MHz. The patients were examined in standing position over a doppler stand as shown in figure 1.³ The diameter of the saphenous vein was measured with B-mode imaging at the level of femoral condyle, and reflux was quantified based on valve closure time and velocity after forced valsalva maneuver using Doppler spectral Measurements as shown in figure 2. The reflux was considered positive if Reflux Time (RT) was more than 500 ms and/or Peak Reflux Velocity (PRV) more than 30 cm/sec.⁴ The contralateral limbs with no reflux were tagged as normal limbs. The limbs with aneurysmal dilatation of GSV, limbs with accessory saphenous vein larger than main saphenous veins and post-operative cases of varicose veins were excluded from the study.

Data analysis was performed using Statistical Package for Social Sciences (SPSS) 25.0. Student t-test was applied to compare the mean diameter of normal and refluxed saphenous vein. Receiver operating characteristics (ROC) curve analysis was applied to determine the best cutoff diameter of the saphenous vein for predicting saphenous



Figure 1. Patient standing on “dopler stand” and great saphenous vein diameter measured in B mode



Figure 2. Color duplex spectrometry quantifying the reflux at sapheno-femoral junction

reflux. A p-value < 0.05 was considered statistically significant.

RESULTS

Total of 792 limbs were evaluated for reflux. The baseline demographic details are shown in table 1. Out of 782 limbs; reflux was positive in 452 and no reflux at Sapheno-Femoral Junction (SFJ) in 340 patients. Among the cases 47.50 % (n=188) were male and 52.5% (n=208) were female.

Table 1. Baseline demographic details of patients.

Characteristics	Value (%)
Sex	Male 188(47.5)
	Female 208(52.5)
Age (Years)	44.17 ± 14.12
Great Saphenous Vein	Normal 340(42.92)
	Reflux 452(57.08)

Diameter of GSV in normal and reflux limbs are shown in table 2. The mean diameter of GSV at femoral condyle with reflux was 5.68 ± 2.07 mm while mean diameter of GSV at

femoral condyle in normal limb (without Reflux) was 4.0 ± 1.34 . The diameter of GSV in reflux vein is significantly larger than the normal GSV ($p < 0.05$).

Table 2. Diameter/Size of great saphenous veins and sapheno-femoral junction

Vein (Diameter/Size)	Normal (mm)	Reflux (mm)	Difference (mm)	p value
Great Saphenous Vein at Femoral Condyle Level	4.0 ± 1.34	5.68 ± 2.07	1.68	0.0001
Saphenofemoral Junction	6.16 ± 1.93	8.23 ± 2.64	2.7	0.0001

Similarly, the size of Saphenofemoral junction (SFJ) was 8.23 ± 2.64 in refluxed vein and 6.16 ± 1.93 in normal vein. The difference in size was 2.7 mm which is statistically significant ($p < 0.05$).

Receiver operating characteristic curve ROC curves used to find the best GSV diameter to predict the SFJ incompetence is shown in figure 3. A GSV diameter threshold of 4.50 mm had best ability to predict the SFJ incompetence. The sensitivity and specificity at this threshold were 81.8% and 71.3% respectively. ROC curve was plotted separately for both left and right limbs which gave similar cut-off value.

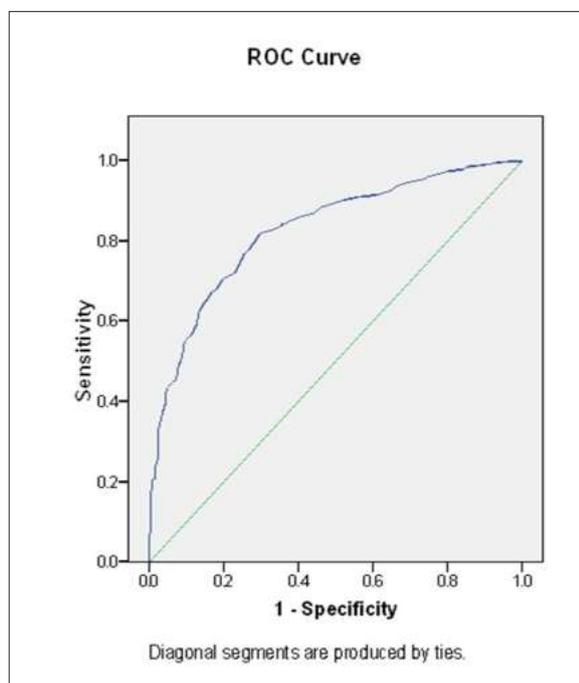


Figure 3. Receiver operating characteristic curve analysis for determining best great saphenous vein diameter to predict SFJ incompetence.

DISCUSSION

In most of the diseased limbs, varicose veins can easily be diagnosed on clinical judgment however the Duplex Ultrasound (US) has become the gold standard for the

evaluation of varicose veins.⁵ US not only diagnoses the condition but also finds the cause of varicose vein and helps in proper management.^{4,6} This investigation tools delineate the anatomy, physiology and hemodynamics of the veins.⁷ The venous reflux is considered the main pathology in the physiology of varicose veins.⁸ There are several studies done in past to quantify the venous reflux by its Reflux Time and Peak Reflux Velocity. Peak Reflux Velocity of 27.4 cm/sec and/or Reflux Time of more than 500 ms at SFJ considered as SFJ incompetence.⁴ The quantification of superficial venous reflux by an Color Duplex USG is very demanding and skillful modality.⁹ High resolution USG and skilled person is required to perform this quantification which is not possible in a resource limited area like Nepal. Thus, study on indirect measurement of SFJ incompetence has a critical value in diagnosing the SFJ incompetence. Engelhorn et al. made an effort to compare the size of GSV and its relation with SFJ incompetence.¹⁰ He found that GSV diameter thresholds equal to or greater than 7 mm, 4 mm, and 4 mm at the SFJ, thigh, and calf, respectively, can most accurately predicted reflux. Navarro et al. in another study reported that a GSV diameter of 5.5 mm or less predicted the no reflux in GSV system.¹¹ One of the largest studies done on 777 patients in Korea found that GSV diameter of > 5.05 mm had the best predictive value for pathological reflux.¹² A similar study done in our institution by Karmacharya et al. in 2018 concluded 5 mm diameter of GSV at the level of Femoral condyle as a cut-off value for SFJ incompetence.³ In this current study we found that the best cut-off value of GSV diameter at femoral condyle to predict the SFJ incompetence is 4.5 mm or more which is similar to many other studies done in past. In this study the measurement of GSV diameter is made at level of femoral condyle and not in mid-thigh or nears SFJ as per consensus guidelines.¹³ It's easier to locate the femoral condyle and measurement has uniformity.

This is a single center study. In future multicenter study would yield better comparison of great saphenous vein diameter and sapheno-femoral junction incompetence.

CONCLUSION

Venous diameter is significantly related to superficial venous reflux. GSV diameter of > 4.5 mm has the best cut-off value for predicting SFJ incompetence irrespective of gender and side.

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