

# A Peroperative Study on the Anatomical Variation at the Saphenofemoral Junction

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## Abstract

**Introduction:** The term varicose is derived from the Latin word meaning – “dilated.” Varicose veins are defined as dilated, usually tortuous, subcutaneous veins 3 mm in diameter measured in the upright position with demonstrable reflux. Although varicose veins were identified prehistorically, only in the present century, considerable knowledge has been gained concerning the anatomy of venous system of the leg, the physiological mechanism of venous return to heart against gravity, and pathology of the disorder, which has led to many newer treatment modalities. One of the pitfalls in venous surgery lies in inadequate knowledge of the venous physiology and anatomy. In contrast to the anatomy of the arteries, the anatomy of veins is characterized by numerous variations. Hence, a thorough and precise knowledge of the anatomical variations of the great saphenous vein (GSV) and SFJ determines the successful outcome of surgery.

**Materials and Methods:** A descriptive study was carried out on 90 patients who were operated for varicose veins in the Surgery Department, Sree Gokulam Medical College and Research Foundation, Venjaramoodu, Trivandrum, during the period of October 2012–April 2014. All patients were examined clinically after taking a detailed history. They were investigated by ultrasonography venous Doppler to confirm the diagnosis. They were subsequently posted for surgery, the intraoperative findings of which were recorded by measurement and photographs. Patients with recurrent varicose veins and perforator incompetence without saphenofemoral incompetence were not included in the study. For those patients posted for surgery, written informed consent was obtained from each patient and basic patient data were recorded in the pro forma. During surgery, documentation of the following intraoperative findings was done:

- Measurement of the SFJ from the pubic tubercle.
- Description of the tributaries that drain into GSV.
- Presence or absence of duplex veins.

All details regarding SFJ and tributaries were documented through photography and further analysis was done using standard statistic techniques.

**Results:** During the study period, 90 cases of varicose veins were enrolled in the study, of which 35 were male and 55 were female. These patients were evaluated by clinical examination, investigations, and peroperative recording of the findings in the pro forma and the following interpretations were made and compared with other studies.

**Conclusions:** The purpose of the present study was to assess the position of the SFJ in relation to the pubic tubercle and identify the various tributaries draining into the terminal part of GSV. During the allotted period, 90 cases of varicose veins of the lower limb were studied in detail. Analysis of the findings recorded has enabled this study to arrive at the following conclusions:

- The position of SFJ junction is highly variable and should always be marked preoperatively using Doppler. The average measurement of the SFJ from the pubic tubercle was 2.1 cm below and 4.4 cm lateral to the pubic tubercle. There was considerable variation in the number and anatomical course of the tributaries draining into the terminal part of GSV. The most common tributary identified in the study was the superficial epigastric vein and the least identified tributary was the posteromedial vein. Duplication of varicose veins was observed in 9% of the cases.

In conclusion, adequate knowledge of the anatomy of the tributaries at the SFJ and ligating them in combination with GSV stripping is associated with a lower rate of the recurrence of varicose veins and a better quality of life. It is always imperative to explore the first 5 cm of GSV precisely to identify all tributaries at the SFJ (about four tributaries by average) to ensure appropriate surgical technique.

**Key words:** Perforators, Saphenous vein, Trendelenburg operation, Varicose vein

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## INTRODUCTION

*“Varicosity is the penalty for verticality against gravity”*

The term varicose is derived from the Latin word meaning – “dilated.” Varicose veins are defined as dilated, usually tortuous, subcutaneous veins 3 mm in diameter measured in the upright position with demonstrable reflux.<sup>[1-3]</sup>

Although varicose veins were identified prehistorically, only in the present century, considerable knowledge has been gained concerning the anatomy of venous system of the leg, the physiological mechanism of venous return to heart against gravity, and pathology of the disorder, which has led to many newer treatment modalities.

One of the pitfalls in venous surgery lies in inadequate knowledge of the venous physiology and anatomy. In contrast to the anatomy of the arteries, the anatomy of veins is characterized by numerous variations. Even after high ligation and stripping, the common cause of recurrence of varicosities are due to failure to identify the saphenofemoral junction (SFJ) and ligate all the tributaries because of the variations in the region of the saphenous opening, and failure to ligate incompetent perforators; or failure may be due to stripping without ligation of the perforators. Hence, a thorough and precise knowledge of the anatomical variations of the great saphenous vein (GSV) and SFJ determines the successful outcome of surgery.

## MATERIALS AND METHODS

A descriptive study was carried out on 90 patients who were operated for varicose veins in the Surgery Department, Sree Gokulam Medical College and Research Foundation, Venjarmoodu, Trivandrum, during the period of October 2012–April 2014. All patients were examined clinically after taking a detailed history. They were investigated by ultrasonography (USG) venous Doppler to confirm the diagnosis. They were subsequently posted for surgery, the intraoperative findings of which were recorded by measurement and photographs.

Patients with recurrent varicose veins and perforator incompetence without saphenofemoral incompetence were not included in the study. For those patients posted for surgery, written informed consent was obtained from each patient and basic patient data were recorded in the pro forma. During surgery, documentation of the following intraoperative findings was done:

- Measurement of the SFJ from the pubic tubercle.
- Description of the tributaries that drain into GSV.
- Presence or absence of duplex veins.

All details regarding SFJ and tributaries were documented through photography and further analysis was done using standard statistic techniques.

## RESULTS

During the study period, 90 cases of varicose veins were enrolled in the study, of which 35 were male and 55 were female. These patients were evaluated by clinical examination, investigations, and peroperative recording of the findings in the pro forma and the following interpretations were made and compared with other studies.

### Age Distribution

The age of the patients in the study ranged from 22 to 76 years. Maximum cases recorded were those patients more than 46 years of age with the mean age of 48.7 years.

### Occupation Distribution

Majority of the patients were housewives accounting for 55.6% of cases and the second common in the study were sedentary workers including IT professionals, office staff, and other professionals who accounted for 27.7% of cases. Manual laborers accounted for only 13.3% of cases.

### Sex Distribution

The study showed a female predominance with 61.1% of females and 38.9% of males.

### Relation to Body Mass Index (BMI)

Majority of the patients were Class 1 obese (46.7%) and pre-obese (26.7%).

21.1% of patients had severe obesity.

### Mode of Presentation

The patients presented with varied symptoms, of which dilated veins were invariably present in all the cases followed by skin changes – 43 patients (47.8%) and aching pain – 25 patients (27.8%). 21.1% of patients presented with bleeding following rupture of varicose veins.

### Side Distribution

#### *Study of the tributaries*

Intraoperatively superficial external pudendal vein could be identified in 93.3% of cases and superficial circumflex iliac vein could be identified intraoperatively in 96% of cases. Of the five named tributaries, superficial epigastric vein was the most common, being correctly identified in 89 cases included in the study. Anterolateral vein was identified in 27 cases accounting for 30% of total cases in the study and posteromedial vein was identified in 24% of cases.

### Measurement of the SFJ from the Pubic Tubercle Measurement lateral to pubic tubercle

Majority of the measurements taken laterally from pubic tubercle were  $\geq 4$  cm. They accounted for a total of 79% of the cases. The mean measurement in this category was 4.43 cm with a standard deviation of 0.39. For those cases with measurement  $< 4$  cm (21% of cases), the mean measurement was 3.5 cm with a standard deviation of 0.20.

### Measurement below pubic tubercle

Majority of the measurements taken below the pubic tubercle were  $< 4$  cm, 99% of the cases. The mean measurement in this category was 2.1 cm with a standard deviation of 0.70.

### Presence of Bifid Vein

Bifid or duplication of GSV was identified in eight cases. These cases were diagnosed preoperatively by USG venous Doppler and confirmed intraoperatively. They accounted for total of 9% of cases [Figures 1-5].

## DISCUSSION

In the presents study, a total number of 90 patients with primary varicose veins were admitted, investigated, and operated. The results were analyzed.

### Age Distribution

In our study, the age range is from 22 years to 76 years. Malhotra<sup>[5]</sup> in their study comprising 677 patients from both Northern and Southern India had an age range of 18–65 years. In the West Wright *et al.*<sup>[6]</sup> in their study of 1338 patients in England had a range of 20–75 years. In most studies, the prevalence of varicose veins increased with age in both genders.<sup>[7-9]</sup>

The prevalence of varicose veins increases with age because only a few of them are treated and because they are not lethal. The prevalence of varicose veins is not higher than 17–38% in studies of elderly people.<sup>[10,11]</sup>

### Sex Distribution

In our series, male-to-female ratio was found to be 1:1.5. Widmer,<sup>[12]</sup> in Switzerland, recorded a ratio of 1:1 and Callam,<sup>[13]</sup> in England, recorded a ratio of 1:2. The incidence of varicose veins is higher in women than in men aged 40–79 years, but no longer in the group aged 80–89 years according to the Framingham study.<sup>[14]</sup> In Finland,<sup>[15-17]</sup> the incidence rate recorded was significantly higher in women in all cohorts studied (from 40 to 60 years old). The possible reason why varicose veins are more common in females is due to the physiologic states such as pregnancy and menopause and iatrogenic states due to hormone medications, in which the level of female hormones in the circulation is high and these states have

been associated with varicose veins.

### Limb Involvement

In our study, the left lower limb was involved in 22 (44%) cases and the right lower limb was involved in 14 (28%) cases compared to the study conducted by Mackaay *et al.* which showed increased incidence on the left side. The exact reason for the same is unclear.

### Occupation Distribution

In the present study, 55.6% of patients were housewives, 27.7% of patients were professionals, and 13.3% of patients were manual laborers. Significant associations were found with a standing posture at work and varicose veins in both sexes<sup>[18,19]</sup> or in women.<sup>[20]</sup> Work involving heavy lifting was also related to the higher prevalence of varicose veins in one study,<sup>[21]</sup> but not in another (Lee *et al.*, 2003). A study from Finland did not report any association between a sitting posture at work and varicose veins in either gender.<sup>[22]</sup>

### BMI Distribution<sup>[23]</sup>

In the present study, majority of the patients were obese. 46.7% of the patients were Class 1 obese and 21.1% of the patients were Class 2 obese. Only 5.6% of patients had normal BMI. In the Framingham study, the incidence of varicose veins was higher among women who were obese than those who were having normal BMI.<sup>[14]</sup> In the same study, the incidence was also noted to be higher for obese men, but this difference was not statistically significant. A follow-up study in the Netherlands found a higher risk of varicose veins in the obese group compared to the control group in women but not in men.<sup>[22]</sup>

### Varicose Vein and Family History

It was noted that 6.7% of cases had a family history of varicose in the present study. The association between varicose vein and family history is still not clearly identified. In a French study, 134 families were examined: 67 varicose veins patients and their parents and 67 controls and their parents were studied. The prevalence of varicose veins for a person was approximately 90% when both parents suffered from varicose veins, 25% in males and 62% in females when only one parent was affected, and 20% when neither parent was affected.<sup>[23]</sup> However, positive family history does not automatically mean a necessary genetic cause. The family often shares the same environment and lifestyle. They may even have similar occupations and other ways of life exposing them to varicose veins, which could lead to another kind of family-linked cause.

### Variations at the SFJ

The number of tributaries in the present study varied from 2 to 6 during dissection of the proximal 5 cm of the GSV. A similar study by,<sup>[24]</sup> showed that the number

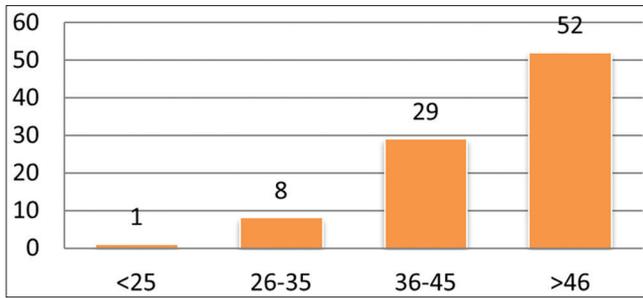


Figure 1: Age distribution

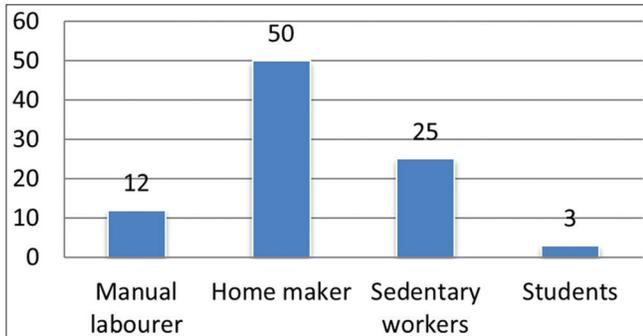


Figure 2: Occupation distribution

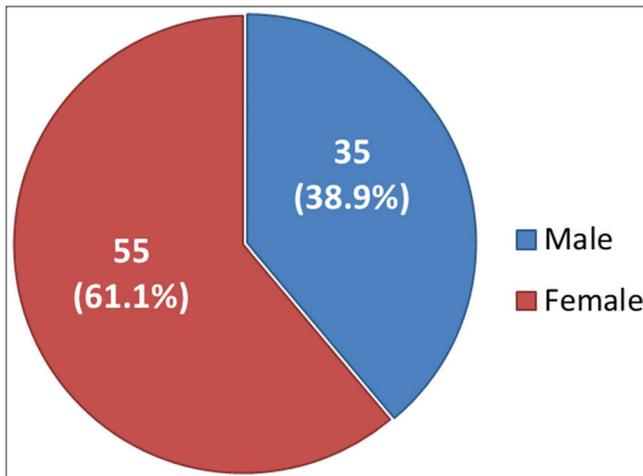


Figure 3: Sex distribution

of tributaries varied from 2 to 7 at the first 5 cm of GSV. According to a paper of Donnelly *et al.*, 2005,<sup>[4]</sup> the tributaries varied from 1 to 10. This variation in number of tributaries may be either due to racial differences or due to different ways of counting the branches. The average number of branches in the study was 3.2 compared to the study by Hemmati *et al.*, 2012,<sup>[24]</sup> which had an average number of branches of 3.87.

The most common branch in the present study was superficial epigastric vein, whereas in the study by Hemmati *et al.*, 2012,<sup>[24]</sup> it was the superficial external pudendal vein. According to a study by,<sup>[25]</sup> the superficial epigastric vein and SCIV were the most common

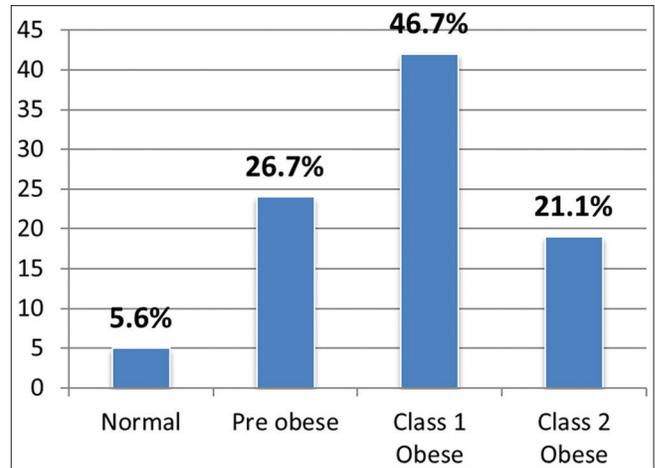


Figure 4: Body mass index distribution

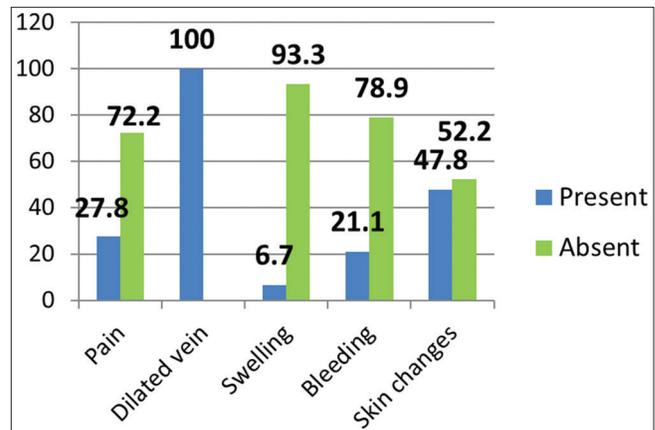


Figure 5: Mode of presentation

Table 1: Side distribution

Side	Frequency (%)
Right	53 (58.9)
Left	37 (41.1)

Table 2: Distribution of tributary

Number of tributaries	Present study (%)
2	12.2
3	54.2
4	22.4
5	8.8
6	2.4

Table 3: Lateral to pubic tubercle < 4 cm

Mean	3.5 cm
SD	0.20102
Minimum	3.0 cm
Maximum	3.8 cm

SD: Standard deviation

tributaries of saphenous vein located close to the SFJ. This might be due to the genetic and regional variations

**Table 4: Lateral to pubic tubercle  $\geq 4$  cm**

Mean	4.43 cm
SD	0.395
Minimum	4.0 cm
Maximum	5.50 cm

SD: Standard deviation

**Table 5: Measurement below pubic tubercle  $< 4$  cm**

Mean	2.1989 cm
SD	0.7023
Minimum	1.00 cm
Maximum	3.8 cm

SD: Standard deviation

**Table 6: Age distribution**

Studies	Age range (years)
Present study	22–76
Malhotra <i>et al.</i>	18–65
Wright <i>et al.</i>	20–75

**Table 7: Sex distribution**

Studies	Male: female
Present study	1:1.5
Widmer <i>et al.</i>	1:1
Callam <i>et al.</i>	1:2

**Table 8: Limb involvement**

Limb	Dur and Mackaay <sup>[17]</sup>	Present study
Right	48.55%	58.9%
Left	51.45%	41.1%

**Table 9: Variation in number of tributaries**

Study	Tributaries
Present study	2–6
Hemmati <i>et al.</i> , 2012 <sup>[23]</sup>	2–7
Donnelly <i>et al.</i> , 2005 <sup>[4]</sup>	1–10

**Table 10: Distribution of tributaries**

Tributary	Present study (%)	Hemmati <i>et al.</i> , 2012 <sup>[23]</sup> (%)
SEPV	93.3	96.4
SCIV	96	92.9
SEV	99	90.3
PMV	24	27.6
ALV	30	70

**Table 11: Percent-wise distribution of tributaries**

Number of tributaries	Present study (%)	Hemmati <i>et al.</i> , 2012 <sup>[23]</sup> (%)
2	12.2	7.9
3	54.2	26.8
4	22.4	41.2
5	8.8	18.9
6	2.4	4.8
7		0.4

and also for the difference of interpretation by surgeons. The least frequent branch in both the present study as well as the study by Hemmati *et al.*, 2012,<sup>[24]</sup> was the posteromedial vein. There were two tributaries in 12.2%, three tributaries in 54.2%, four tributaries in 22.4%, five tributaries in 8.8%, and six tributaries in 2.4%.

### Distribution of Tributaries at SFJ

#### Measurement of the SFJ from the pubic tubercle

The measurements taken laterally from pubic tubercle were  $\geq 4$  cm in most of the cases. They accounted for a total of 79% of the cases. The mean measurement in this category was 4.43 cm with a standard deviation of 0.39. For those cases with measurement  $< 4$  cm (21% of cases), the mean measurement was 3.5 cm with a standard deviation of 0.20. Among the measurements taken below the pubic tubercle, majorities were  $< 4$  cm, 99% of the cases. The mean measurement in this category was 2.1 cm with a standard deviation of 0.70.

### Bifid vein Distribution

In the present study, there was 9% of cases of bifid veins in comparison to 18.1% in the study by Donnelly *et al.*, 2005.<sup>[4]</sup>

## CONCLUSIONS

The purpose of the present study was to assess the position of the SFJ in relation to the pubic tubercle and identify the various tributaries draining into the terminal part of GSV. During the allotted period, 90 cases of varicose veins of the lower limb were studied in detail. Analysis of the findings recorded has enabled this study to arrive at the following conclusions:

- The position of SFJ junction is highly variable<sup>[25]</sup> and should always be marked preoperatively using Doppler. The average measurement of the SFJ from the pubic tubercle was 2.1 cm below and 4.4 cm lateral to the pubic tubercle. There was considerable variation in the number and anatomical course of the tributaries draining into the terminal part of GSV. The most common tributary identified in the study was the superficial epigastric vein and the least identified tributary was the posteromedial vein. Duplication of varicose veins was observed in 9% of the cases.

In conclusion, adequate knowledge of the anatomy of the tributaries at the SFJ and ligating them in combination with GSV stripping is associated with a lower rate of the recurrence of varicose veins and a better quality of life. It is always imperative to explore the first 5 cm of GSV precisely to identify all tributaries at the SFJ (about four tributaries by average) to ensure appropriate surgical technique.

## ACKNOWLEDGMENTS

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### Declaration of Interest

The authors do not declare any conflicts of interest.

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