

A Prospective Study of Incidence of Bifid Great Saphenous Vein

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Abstract

Introduction: The GSV can be identified by the tibio-gastrocnemius angle sign between the distal third of thigh and proximal third of calf on duplex venous ultrasound. Incidence of duplication of GSV varies between 1 and 52 percent. Present study was undertaken to note the incidence of bifid GSV. **Materials and Methods:** A prospective non-randomized study of hundred patients was carried out between June 2016 and May 2017. Pre-operative venous mapping of GSV was carried out. The occurrence of duplicated GSV was recorded. Bifid GSVs were followed up to their origin. Diameter of GSV < 2.5 mm was considered as narrow calibre GSV and diameter > 5 mm was considered as dilated one. All patients underwent trendelenburg's operation. Descriptive statistics were calculated. $P < 0.05$ was considered as statistically significant. **Results:** The mean age of patients was 47. The number of tributaries varied from 2 to 6 at SFJ. Venous duplex ultrasound pre-operatively showed that there was bifid GSV in 4%, narrow calibre GSV in 4% and dilated GSV in 6% patients. Intra-operatively, bifid GSV was present in 6% patients. Two patients had narrow calibre GSV. Intra-operatively we found that in 3 patients GSV's were draining into the SFJ as a common trunk and in remaining patients it was draining in to the junction individually. Maximum frequency of GSV duplication was seen in the thigh region (66.7%) patients followed by in the ankle region in (33.3%) patients. **Conclusion:** True incidence of bifid GSV is difficult to estimate. It is surely less than the available literature suggests.

Our study showed no statistical difference in incidence of bifid GSV on preoperative duplex ultrasound and its subsequent confirmation as intra-operative finding; hence, duplex ultrasound marking of GSV preoperatively is advisable. One should emphasise that the success rate of surgery is relevant to the anatomical variation of GSV and knowledge of same will decrease the recurrence rates of varicose veins.

Keywords: Femoral Vein; Saphenous Vein; Phlebography; Incidence; Varicose Veins; Duplex; Lower Extremity; Recurrence.

Introduction

Venous anatomy is more variable than arterial system as it has more frequent anatomical variations than later one [1]. Knowledge of anatomy of venous system is extremely important for correct evaluation and treatment of venous disorders like varicose veins.

Great saphenous vein (GSV) which is also known as vena saphena magna, is the longest vein of body [2,3]. It commences its course anterior to the medial malleolus and passes upwards along the tibial edge of the medial calf to cross the knee and then along the medial thigh to the saphenofemoral junction (SFJ).

The GSV can be identified from transverse ultrasound images by the tibio-gastrocnemius angle sign (TG angle sign) between the distal third of thigh and proximal third of calf. This ultrasound sign has been described in subjects with and without varicose veins [4].

Among various venous anatomical variations in lower limbs, one of the important and significant variation is duplication of GSV [5]. The reported incidence of duplication of GSV varies between 1 and 52 percent [6]. A study showed that one of the major

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cause of recurrences of varicose veins was non-identification of bifid GSV system and presence of its non ligated junctional tributaries [2].

Present study was undertaken to accurately note the incidence of bifid GSV system in patients with primary varicose veins. We also compared the pre-operation Duplex Ultrasonography findings and Intra-operative findings in patients with bifid GSV system.

Materials and Methods

A prospective non-randomized study of hundred patients was carried out in our hospital between June 2016 and May 2017. Demographic details of all patients were recorded. Diagnosis of varicose vein was established by clinical examination and venous duplex ultrasound study of the lower limb venous system using micromax ultrasound system with linear probe C60e/52 MHz (low frequency) and HFL38/136 MHz (high frequency). Duplex ultrasound was performed by the same experienced radiologist in all the 100 patients.

Patients with secondary varicose veins, recurrent varicose veins and those not willing to undergo open surgical treatment were excluded from study.

Pre-operative venous mapping of GSV and femoral vein were carried out meticulously with the help of venous duplex ultrasound. The GSV was identified from transverse ultrasound images by the TG angle sign between the distal third of thigh and proximal third of calf. The saphenous eye consists of the superficial fascia and the deeper aponeurotic fascia. In the thigh GSV in its "saphenous eye" was marked, as it was difficult to recognise the GSV and its fascia forming the "saphenous eye" near the knee.

The occurrence of duplicated systems of the GSV was recorded. All variants of bifid GSV such as partial duplicated GSV with common trunk, total duplicated GSV separately draining into SFJ, duplication with narrow or dilated calibre GSV were considered as single bifid GSV system in our study, as our main goal was to obtain the incidence of duplication of GSV. The bifid GSVs were followed up to their origin and to their location between the fascial compartments. Diameter of GSV less than 2.5 mm within 15 cm of SFJ was considered as narrow calibre GSV whereas, GSV diameter more than 5 mm was considered as dilated one.

All patients underwent trendelenburg's operation, stripping of GSV, and hook phlebectomy of affected perforators if and when required. Dissection of the saphenofemoral junction (SFJ) was carried out using

fix 4 cm oblique incision, 2 cm lateral, and 1 cm inferior to pubic tubercle with its centre over the SFJ. The incision was carried down through the subcutaneous tissue, and the GSV was identified. Bifid GSV were stripped by two separate incisions post confluence to the common trunk whenever required. We did retrograde conventional GSV stripping in all our 100 cases.

Descriptive statistics were calculated by measuring mean, standard deviation (SD), and proportions with 95% confidence interval. Paired *t* test was used to compare the pre-operative venous duplex ultrasound and intra-operative results. *P* < 0.05 was considered as statistically significant. Graphical presentation was done by using Microsoft Excel.

Results

Out of hundred patients of varicose veins, 72 were male and 28 were female. The mean age of patients was 47 (range: 20–74 years). In our study, the number of tributaries varied from 2 to 6 at SFJ. The mean number of tributaries was 3.78 with an SD of 0.99. We found that there were minimum of two tributaries and maximum of six tributaries in two patients each.

Venous duplex ultrasound pre-operatively showed that there was bifid GSV in 4 (4%) patients, narrow calibre GSV in 4 (4%) and dilated GSV in 6 (6%) patients. Intra-operatively however, we found that actual bifid GSV was present in 6 (6%) patients [Table 1]. *P* value was not significant. Two patients had narrow calibre GSV. We observed that 6 patients who were pre-operatively reported having dilated GSV, had intra-luminal calibre more than 8 mm. We couldn't find narrow calibre GSV intra-operatively in rest 2 patients, whose duplex scan showed otherwise [Table 2]. There was no significant *P* value.

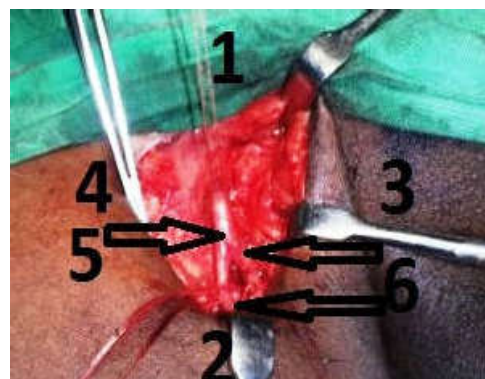


Fig. 1: Right side bifid GSV with common trunk draining into the SFJ. Description: 1: Cranial side, 2: Caudal side, 3: Medial side, 4: Lateral side, 5: Common trunk of GSV draining into the Femoral vein, 6: Bifid GSV.

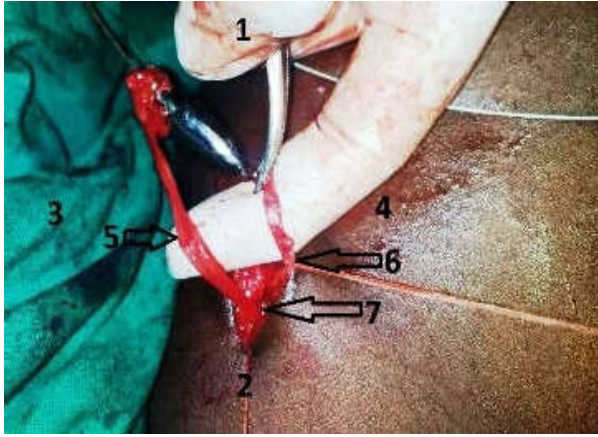


Fig. 2: Left side bifid GSV with two separate veins draining into the SFJ. Description: 1: Cranial side, 2: Caudal side, 3: Medial side, 4: Lateral side, 5,6: Bifid GSV after flush ligation which were draining individually into the SFJ, 7: Common trunk of bifid GSV located distally.

Intra-operatively we found bifid GSV system in total 6 patients, in three of them GSV's were draining into the SFJ as a common trunk [Figure 1]. However, in remaining patients it was draining in to the junction individually [Figure 2].

In our study of 100 patients with varicose veins i.e. out of total 6 lower limbs with GSV duplication 5 were right [Figure 1] and only 1 was left sided. [Figure 2].

We observed that, maximum frequency of GSV duplication was seen at saphenofemoral junction in the thigh region in 4 (66.7%) patients followed by in the ankle region in 2 (33.3%) patients. We didn't find any variant of GSV duplication in the knee region in our study [Table 3].

Table 1: Comparison of duplex venous ultrasonography and intra-operative findings in Bifid GSV

Parameter	Duplex Venous Ultrasonography (N=100)	Intra-operative (N=100)	P value
Bifid GSV	4	6	>0.05

Table 2: Comparison of narrow and dilated GSV on duplex venous ultrasonography and intra-operative findings

Parameter	Duplex Venous Ultrasonography (N=100)	Intra-operative (N=100)	P value
Narrow GSV (< 2.5 mm diameter)	4	2	>0.05
Dilated GSV (> 5 mm diameter)	6	6	>0.05

Table 3: Intra-operative location of GSV duplication

Parameter	Intra-operative location of GSV duplication
Thigh region	4
Knee region	2
Ankle region	0
Total (N)	6

Discussion

Dilated and tortuous veins are called as varicose veins [5]. It is fairly a common medical condition seen in people with long standing history, with estimated prevalence rate ranging between 12% to 40% in men and 25% to 73% in women [8].

Varicose veins recurrence post treatment, be it surgical or with laser ablation is not an uncommon entity in today's world. According to the available literature, recurrence rate of varicose vein is as high as 20% [9]. Various associated factors with varicose vein recurrence are improper and incomplete initial assessment, inadequate primary surgery, failure of identification of bifid GSV system, variations at SFJ and neovascularization at a previously ligated SFJ [7,10,11]. Bifid GSV is one of the important cause

associated with the recurrence of varicose veins, if not identified preoperatively and ligated meticulously during surgery. Available literature about the bifid GSV system is very scarce, although there are many articles about the GSV anatomy [12].

Great saphenous vein (GSV) previously known as Long saphenous vein (LSV) is an important vein of the superficial venous system of the leg. It begins as a continuation of the dorsal venous arch in the foot. GSV then travels anterior to the medial ankle ascending on the medial side of the leg, ultimately draining in to the SFJ in the common femoral vein.

The anterior accessory saphenous vein (AASV) and/or posterior accessory saphenous vein (PASV) can occasionally join the GSV and lie within one of the saphenous compartment. They usually then drains in to the SFJ as a common trunk or separately [13].

The GSV normally has a single trunk along the medial side of the thigh, which drains directly in to the SFJ [13]. Anomalous duplication aka bifid GSV can be seen in some individuals where, these two GSVs usually lie in the same plane and run along the aponeurotic deep fascia [14]. These two GSV's usually has similar diameter, which can be narrow or dilated compared to the single GSV.

The incidence of duplication of GSV varies between 1 and 52 percent in available literature [6]. The incidence of bifid GSV was as high as 24% according to Mansberger et al [15]. Some other studies showed 18.1% [16] and 5.7% [17] incidence of same respectively.

We found wide variation in incidence of bifid GSV in our meticulous literature search. In the large study of 1400 and 610 limbs, Kupinski et al and Ricci et al found that incidence of GSV duplication was 8% and 1% respectively [18,19]. In our study, we observed that actual duplication of GSV was present in 6% patients.

Lack of objective parameters for identification of GSV before the consensus paper of the Union International de Phle'bologie (UIP) in 2006 was the major reason for misinterpretation in duplication of GSV system and its estimated incidence [19]. Kockaert et al in their retrospective study of 48 articles and reports on GSV duplication, found that for accurate diagnosis of bifid GSV pre-operative duplex ultrasound scanning, phlebography and intra-operative correlation or combinations of these three modalities are mandatory [12]. Many studies who had higher or lower incidence rate of bifid GSV system in their study, only utilized duplex ultrasound scan or phlebography for diagnosis or they didn't match their pre-operative findings with intra-operative findings, which might be the result for such results.

One study used phlebography as a single outcome parameter for the diagnosis of GSV duplication and noted that 49% of their phlebographies showed duplications of GSV and only one patient actually had true duplication in the thigh and another one in the calf [20]. One retrospective study which, used duplex ultrasound for diagnosis of bifid GSV noted 1.6% incidence of a true duplication whereas, partial duplication was seen in 24.6% cases in which the GSV was not embedded completely between the fascial blades [12]. In our prospective study, duplex scans demonstrated duplication of GSV in 4% cases however, intra-operatively it was present in 6 cases. Statistical findings were insignificant and hence we strongly believe that, pre-operative duplex ultrasound is useful diagnostic method to diagnose

bifid GSV. We also agree with Kockaert et al that, true duplication of the GSV is less common than the available literature has suggested and combining the duplex ultrasound results and intra-operative findings true duplication of GSV can be estimated accurately.

A study of 156 young adults, with varicose veins detected bifid sa-phenous veins in 9 (5.7%) patients [17]. Three GSV's out of 9 in their study, were draining in to the SFJ as a common trunk and remaining six were draining individually [17]. In our study, during surgery, we observed that, 3 out of 6 GSV's were draining in to the SFJ as a common trunk and remaining were draining individually.

Intra-operatively we observed that, maximum frequency of GSV duplication was seen at SFJ in the thigh region in 66.7% patients, followed by in the ankle region in 33.3% patients. We didn't find any variant of GSV duplication in the knee region in our study. Rai et al, in their cadaveric study of GSV in 30 lower limbs found that, frequency of GSV duplication was maximum in the ankle region (58.33%) followed by, 40% in thigh. They also observed that, duplication of GSV was least seen in the knee region, which was present in the 8.33% cadaveric limbs [21]. We couldn't find any other available literature mentioning the location of bifid GSV intra-operatively.

Conclusion

Variations in the anatomy of Great saphenous vein, it's course and anomalous duplication pattern of GSV should be well versed to the operating surgeon which is immensely important in planning varicose vein treatment.

True incidence of bifid GSV is difficult to estimate at present and it is surely less common than the available literature has suggested. Combining the pre-operative duplex ultrasound results and intra-operative findings accurate incidence of GSV duplication can be estimated.

Our study showed no statistical difference in incidence of bifid GSV on preoperative duplex ultrasound and its subsequent confirmation as intra-operative finding; hence, duplex ultrasound marking of GSV preoperatively is advisable for planning a proper surgery.

One should emphasise that the success rate of the Trendelenberg's procedure or Laser ablation of GSV is relevant to the anatomical variation of GSV and knowledge of same will decrease the recurrence rates of varicose veins.

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