Original article:

Drainage pattern of the tributaries of Great Saphenous vein at thigh in South Indian population – A cadaveric study

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Abstract:

Introduction: The anatomy of great saphenous vein with regard to the drainage pattern of its tributaries at saphenofemoral junction shows much variation. In order to define the precise anatomy of the tributaries of Great saphenous vein, a study was conducted on the drainage pattern aiming to assess the most frequently occurring pattern in South Indian population.

Materials and methods: The present study was done in 44 cadaveric lower limb specimens belonging to both sexes of South Indian population by dissection method and the details of the drainage pattern were recorded, analysed and compared with those of the previous studies.

Results: The anterolateral tributary drained in common with superficial circumflex iliac vein and superficial epigastric vein in majority of specimens. In 4% of specimens, double GSV was reported.

Conclusion: The knowledge of variations in the drainage pattern of the tributaries of great saphenous vein helps prevent recurrence of varicosity even after surgical intervention or thermo ligation procedures.

Introduction:

The superficial veins of lower limb begin in the foot forming two separate channels, the Great (long) saphenous vein and Small (short) saphenous vein. The formation of great saphenous vein is found to be highly variable and it usually originates from the medial side of the dorsum of the foot.[1] It ascends anterior to the medial malleolus of Tibia, then it passes along the medial border of tibia and reaches the knee, posterior to the medial edge of patella. It travels further on the medial aspect of thigh to reach the saphenous opening.[2] The great saphenous vein begins by the union of dorsal digital vein of medial side of great toe with the medial end of dorsal venous arch.[3,4,5] The level of termination of great saphenous vein into the femoral vein at fossa ovalis [6] is situated 2.5-3.5cm inferolateral to the pubic tubercle [7], 10.8 cm from anterior superior iliac spine [8], one and half inches below the inguinal ligament.[4] Sometimes the Great saphenous vein is duplicated[9,10]. The tributaries of great saphenous vein at the level of ankle include the medial marginal vein. In the leg, three tributaries draining the front of the leg, the tibial malleolar region and the calf are present distal to the knee. The tributary draining medial malleolar region is called the posterior arch vein, first described by Leonardo Da Vinci.[2] In its course, the great saphenous vein is closely related to saphenous nerve[11] and external pudendal artery.[12]

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In the thigh, the tributaries are grouped as posteromedial tributaries, anterolateral tributaries and peri inguinal tributaries[13,14]. The posteromedial vein is sometimes double and quite often called as accessory saphenous vein. The anterolateral vein of the thigh courses along the lower half of femoral triangle to end in great saphenous vein. The peri-inguinal tributaries namely the superficial epigastric, superficial circumflex iliac and superficial external pudendal veins drain into great saphenous vein with different modes of union. [15,16,17] Sometimes the tributaries drain into the Great saphenous vein in a conventional type with a 'vein star' shape. [18]

Thomas S Glasser[18] (1943), demonstrated nineteen venous drainage patterns based on the dissection of fossa ovalis (saphenous opening) region of hundred cadaveric lower limb specimens. Daseler[19](1956), observed eight different patterns of drainage following dissection at the upper end of great saphenous vein in 550 specimens. Chun et al[20] (1992), studied the different drainage pattern of saphenous tributaries in 249 lower limbs of Korean population. The drainage pattern of tributaries presents ample variation. Failure to ligate all superficial veins increases the appearance of varicosities even after high ligation and stripping of great saphenous vein.

Aims and objectives:

The present study aims at giving a comprehensive orientation on the drainage pattern of superficial tributaries of great saphenous vein at sapheno femoral junction. The results are correlated with those of previous authors' study.

Materials and methods:

44 adult lower limbs from 22 embalmed cadavers belonging to both sexes from the Institute of Anatomy, Madras Medical College were obtained. The dissection was carried out by placing two incisions, one horizontally and another vertically in the thigh region. The horizontal incision extended from anterior superior iliac spine to pubic tubercle and vertically from pubic tubercle to medial malleolus along the medial aspect throughout. The skin and superficial fascia was reflected, then the veins were isolated and separated from the surrounding tissue. Its entry into femoral vein was noted. The tributaries of great saphenous vein from ankle, leg and thigh were noted. The drainage pattern of the periinguinal tributaries were further studied in detail. Apart from this, the drainage pattern was grouped based on the classification proposed by Glasser, Daseler and Chun et al and the results of the present study were compared with those of the authors. A compiled tabulation describing the drainage patterns of the tributaries at saphenofemoral junction formulated by Glasser and Daseler is given in table 1.

Observations and results:

Tributaries at thigh:

1. Periinguinal Tributaries:

A) Superficial epigastric vein(Fig.1):

The SEV drained directly into GSV in 50% of limb. The SEV drained in common with SCI and AL tributary in 36%. In 10% of limbs the SEV drained along with SCIV alone .

The least common pattern observed in 4% of specimens was the drainage of SEV along with

EPV .

B) Superficial circumflex iliac vein(Fig.2):

This tributary drained directly into the GSV at SFJ in 40% of the limbs .In the remaining limbs , the vein drained in combination with the periinguinal

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tributaries . the majority of specimens 36% showed a pattern wherein the SCIV drained along with SEV and AL tributary . In 10% of the limbs the vein drained along with SEV only .and in 12% of limbs , the vein drained with AL tributary alone.

C) Superficial external pudendal vein(Fig.3):

In 90% of specimens, the SEPV drained directly into GSV. In 6% of specimens , the EPV drained along with PM tributary and in 4% the vein drained by joining with SEV.

2. Anterolateral Vein of Thigh:

The percentage of specimens belonging to different modes of drainage of anterolateral vein of the thigh is shown in table 2.

3. Posteromedial vein of thigh:

The percentage of specimens belonging to different modes of drainage of anterolateral vein of the thigh is shown in table 3.

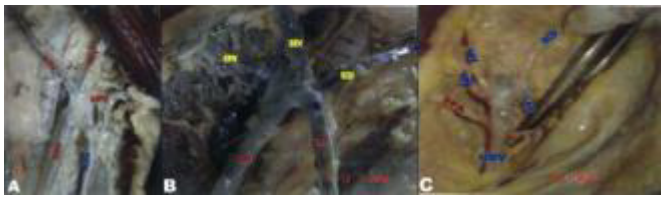

Figure 1: shows A) SEV draining directly into GSV, B) SEV in combination with SCIV and ALV, C) SEV and SEPV draining with a common trunk.

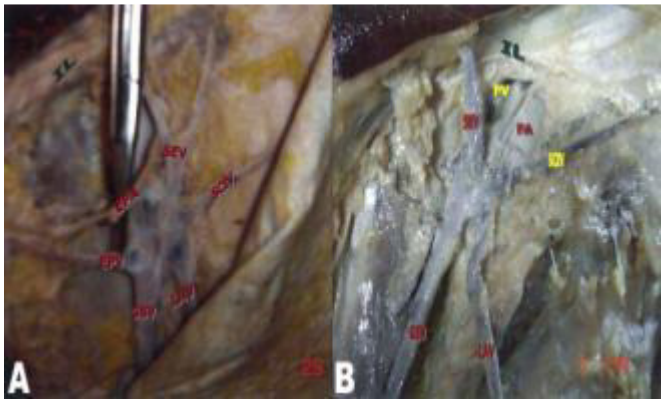

Figure 2: A) shows SCIV draining directly into GSV, B) shows SCIV draining in common with ALV.

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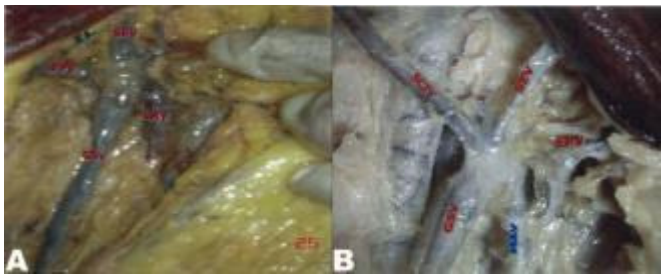

Figure 3: shows A) SEPV draining directly into GSV, B) SEPV in common with PMV.

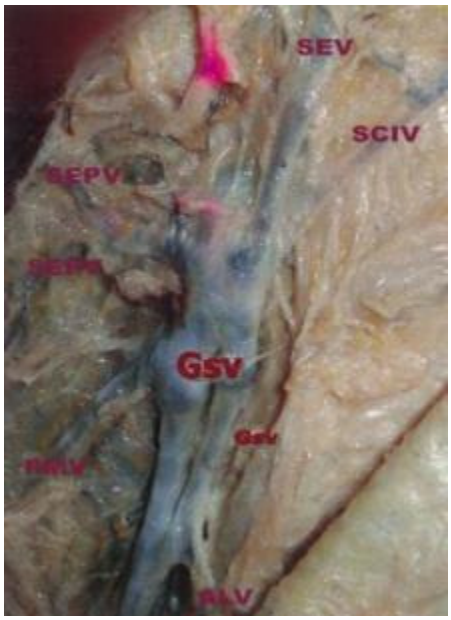

Figure 4: shows double GSV with double SEPV.

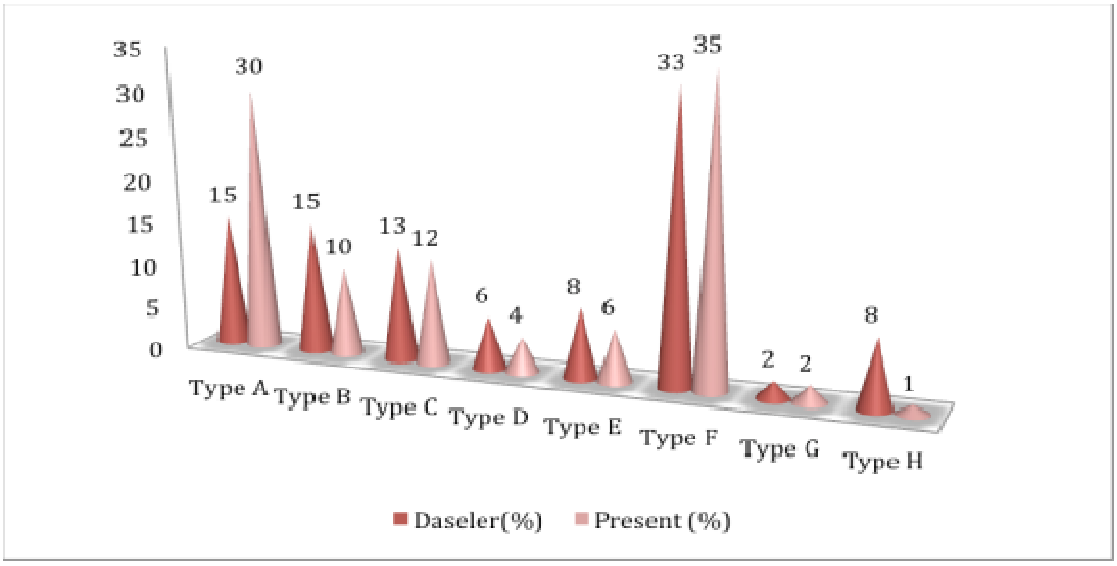

Figure 5: Comparison of drainage pattern between present study and Daseler's study.

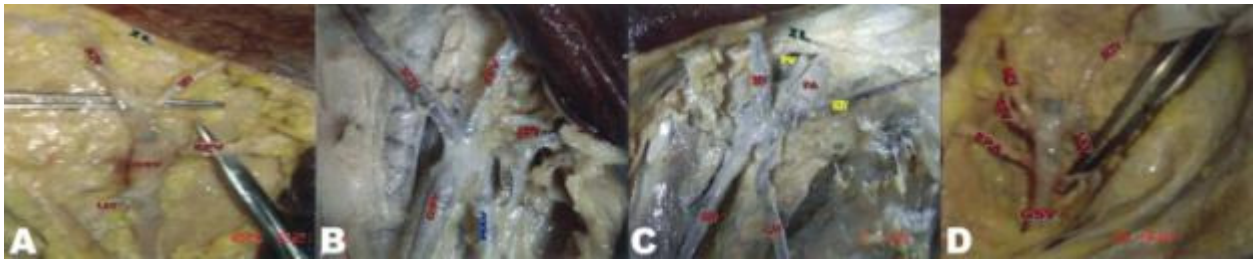

Figure 6: shows A) Type I(A), B) Type II(B), C) Type III(C), D) Type IV(D) of Daseler's classification.

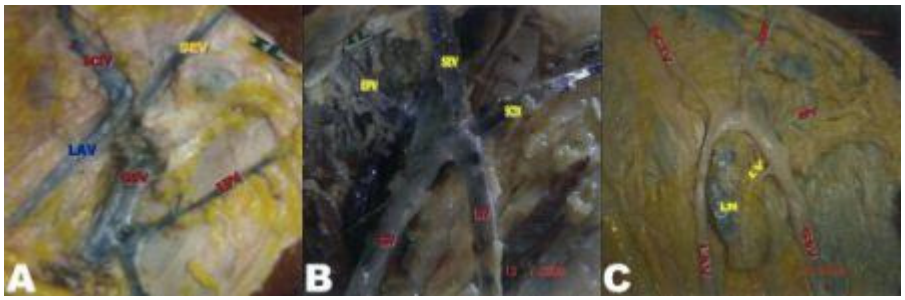

Figure 7: shows A) Type V(E), B) Type VI (F) – "**Vein star" shape**, C) Type VIII(H) of Daseler's study.

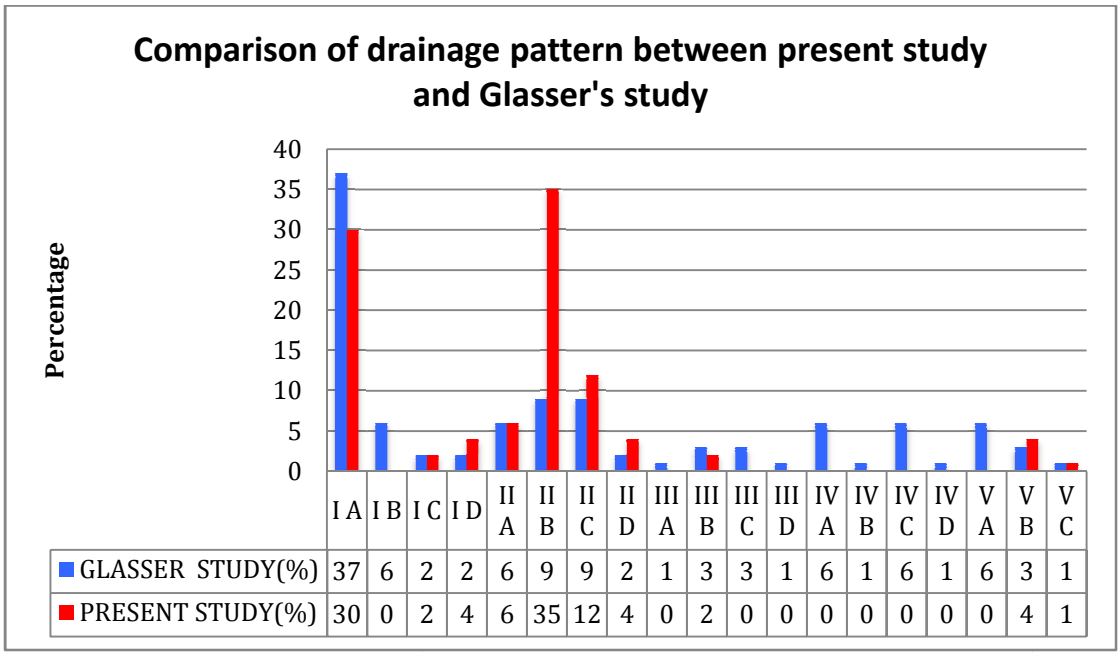

Figure 8: Comparison of drainage pattern between present study and Glasser's study.

TABLE 1: DRAINAGE PATTERN AT SAPHENO FEMORAL JUNCTION ACCORDING TO GLASSER AND DASELER (COMPILED)

S NO	PATTERN	GLASSER	DASELER
1.	SCIV, SEPV and SEV drain at fossa ovalis. PMV and ALV drain below fossa ovalis.	I A	
2.	PMVs and ALVs – multiple	I B	
3.	ALV – Large and drains at fossa ovalis. TEV – inconstant	I C	I (A)
4.	ALV and PMV drain into fossa ovalis.	I D	
5.	PMV forms a common trunk with SEPV	II A	V (E)
6.	ALV, SEV and SCIV drains by forming a common trunk into GSV.	II B	VI (F)
7.	ALV and SCIV drains by forming a common trunk	II C	VIII (H)
8.	SEV and SEPV form a common trunk and drain into GSV.	II D	IV (D)
9.	PMV present. Double SEPV s present.	III A	
10.	Double SEPV s drain at fossa ovalis.	III B	
11.	SEV drain into GSV below fossa ovalis	III C	
12.	SCIV drains into FV	III D	
13.	Collaterals drain into FV	IV A	
14.	ALV and SCIV form a common trunk. Collateral veins into FV.	IV B	III(C)
15.	ALV drains at fossa ovalis. SEV drains into FV.	IV C	
16.	PMV s and ALV s have small caliber. SCIV and SEPV drain into FV.	IV D	
17.	ALV drains into FV	V A	
18.	Double GSV joins at Fossa ovalis.	V B	
19.	GSV drains into FV one inch below the fossa ovalis.	V C	

DASELER'S STUDY: Type II (B) - SEV and SCIV forms common trunk.

Type VII(C) - ALV and SEV forms common trunk and

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drains into GSV.

PMV-Posteromedial vein, ALV-Anterolateral vein, SCIV-Superficial Circumflex Iliac Vein, SEV-Superficial Epigastric Vein, SEPV-Superficial External Pudendal Vein, GSV- Great Saphenous Vein, FV – Femoral Vein.

TABLE 2: DRAINAGE PATTERN OF THE ANTERO LATERAL TRIBUTARY OF GREAT SAPHENOUS VEIN.

S.No	**Drainage Into GSV**	**No of cases**	**Percentage**
	A) At Fossa Ovalis		
1.	Directly	19	38
2.	In common		
a)	With SCIV and SEV	18	36
b)	With SCIV only	6	12
c)	With TEVand SCIV	1	2
	B) Below Fossa Ovalis		
3.	Directly	6	12

SCIV-Superficial Circumflex Iliac Vein, SEV-Superficial Epigastric Vein, SEPV-Superficial External Pudendal Vein, TEV – Thoraco Epigastric Vein.

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TABLE 3: DRAINAGE PATTERN OF POSTEROMEDIAL TRIBUTARY OF GREAT SAPHENOUS VEIN .

S.no	Drainage Into GSV	No of cases	Percentage
	A)At fossa ovalis		
1.	Directly	3	6
2.	Incommon With external pudendal vein	3	6
	B)Below fossa ovalis		
3.	Directly	44	88

TABLE 4: DRAINAGE PATTERN AT SAPHENO FEMORAL JUNCTION BASED ON CHUN ET AL CLASSIFICATION

S.no	Vein	DIRECT %		COMMON %	
		Chun	Present	Chun	Present
1.	PMV	82.3	94.2	17.7	5.8
2.	ALV	67.1	50.6	32.9	49.4
3.	SCIV	83.1	39.4	16.9	61.6
4.	SEV	77.1	48.3	22.9	51.7
5.	SEPV	95.2	90.2	4.8	9.8

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Discussion:

Expertize in venous anatomy and its variations are necessary for the interventional treatment modalities. Surgical and minimally invasive procedures require the knowledge on the drainage pattern of superficial veins at sapheno femoral junction.

In the present study, type II B was the most commonly observed pattern which was four times higher than that of Glasser's study. The second common pattern observed was IA, which was slightly less than Glasser study.

The types IC and IIA matched with Glasser's study. The unrecorded patterns were IB,IIIA,IIIB,IIIC,IIID,IVA,IVB,IVC,IVD,VA and VC.

Duplicated great saphenous vein was found in 4% in accordance with Glasser's study(**Fig.4**).The most common observation seen in 35% of specimens in the present study was that all three peri-inguinal tributaries drained into the GSV by a common trunk(VI-F) which was near equivalent to Daseler's study(**Fig.6,7**). A strikingly constant observation in the present study was the presence of a large and constant anterolateral tributary draining into the GSV(I-A). In contrast to Daseler's observation, the study showed Type(I-A) to be twice the percentage of occurrence. The type VII(G) was not noted even in a single specimen in the present study.

The percentage of specimens classified according to Chun et al was compared with the author's study and shown in table 4. The tributaries, PMV and SEPV were found to drain directly into GSV in 94% and 90% of specimens respectively. But the SCIV was found to drain in combination with other tributaries in majority of specimens (62%). The ALV and SEV drained directly and in combination equally. The pattern of drainage when compared to Chun et al study, SCIV and SEV showed much variance. In majority of specimens, the anterolateral tributary drained into the GSV either directly or forming a common trunk along with SCIV and SEV at fossa ovalis, whereas the posteromedial vein was found to drain directly into the GSV below fossa ovalis.

Conclusion:

The primary application of this research was to emphasise the variations in the drainage pattern of the superficial tributaries of GSV at sapheno femoral junction that should potentially be considered during ligation, stripping or thermo ablation procedures for primary varicose vein treatments. The significant pattern of drainage observed distinctly in the South Indian population in whom the present study was conducted showed the anterolateral vein draining into the GSV, forming a common trunk with SCIV and SEV. The GSV was duplicated in 4% of specimens. The presence of double SEPV was seen in 2% of specimens. The knowledge of this drainage pattern is significant, failing which the tributaries may be missed or left open during various procedures done for the treatment of varicose veins.

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