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Cadeveric study of variations of great saphenous vein in south Bihar population

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Abstract
Introduction: Great saphenous vein is the longest vein in the body begining from the medial end of dorsal venous arch of foot by joining medial marginal vein. It ascend upward and ends by joining femoral vein through saphenous opening in the femoral triangle. Venous drainage of lower limb mainly by the sets of superficial veins and deep veins. Superficial vein include great and small saphenous veins. Superficial veins connected to the deep veins by perforators.
Background: As compared to arterial system variations are more commonly seen in venous system. In the superficial veins of lower limbs varicosities are more commonly seen.
Aim: To study the variations of Great Saphenous Vein in cadever of South Bihar Population.
Methods: Total 32 for maline fixed lower limb were dissected superficially for the study of course, perforators and tributaries of great saphenous vein. Various measurements were taken from saphenofemoral junction to the origin of perforators and tributaries. Duplication of veins were also reported.
Results: The mean distance of perforators and tributaries were compared with the previous study and patterns of duplication of GSV were also reported.
Conclusion: The present study would be of great help for the managements of varicose vein and also helpful for surgeons and cardiologist as it is used in coronary bypass surgery as autograft.

Keywords: Cadever, great saphenous vein, perforators and tributaries of GSV, duplication, varicose vein

Introduction

Venous drainage of lower limb is governed by the superficial veins, deep veins and perforators which communicate superficial veins with deep veins. Superficial veins mainly include great and small saphenous vein. Deep veins mainly include tibial, peroneal, popliteal and femoral vein. All these sets of veins have numerous valves for unidirectional flow of blood.

Great saphenous vein (GSV) also called long saphenous vein is the longest vein in the body which begins from the medial end of of dorsal venous arch of foot and soon joined by medial marginal vein. It passes in front of medial malleolus then straight up to the posteromedial aspect of knee joint about one hand breadth posterior to patella and finally ascends to saphenous opening and terminated by joining femoral vein. Great saphenous vein is closely related with the saphenous nerve that lie anterior to vein at ankle but posterior to it at knee.

The Great saphenous vein is joined by posterior arch vein and anterior leg vein below the knee. In the thigh GSV receves the posteromediali vein (also called accessory saphenous vein) and anterolateral vein just before piercing cribriform fascia. External pudendal, inferior epigastric and circumflex iliac vein form the main tributaries of Great saphenous vein.

Many number of perforating vessels connect the tributaries of GSV with the deep veins which include perforator in adductor canal, knee perforator connecting GSV with tibial vein, three medial ankle perforators connecting GSV with posterior tibial vein and one lateral ankle perforator connecting small saphenous vein with peroneal vein. Perforators have valves at each end for unidirectional flow of blood from superficial to deep veins.

Arrangements of venous drainage of lower limb varies considerably from subject to subject and even limb to limb. Hence the knowledge of these variations is of great significance. Some of the reports mention the incidence and patterns of duplication or have drawn attention to the possible role of this variation as a source of recurrent varicose vein. The Great Saphenous Vein is often duplicated especially distal to the knee. The incidence of duplication has been reported to be between 1 and 50 percent. The saphenous vein is usually chosen when obstructive coronary heart disease is surgically treated with graft of autogenous veins anastomosed between aorta and coronary arteries.

Many number of authors have reported the variations possible in tributaries and course of great saphenous vein. Some also has been focused on the possible measurements Of GSV in relation to sapheno – femoral junction. Hence the understanding of anatomy of venous system will be of great help to surgeons, cardiologist, Radiologist and would help in diagnosis and management of venous disorder.

Methods

Total 32 formalin fixed adult lower limb were dissected (16 right side and 16 left side) in the Department of Anatomy, J.L.N. Medical college, Bhagalpur, Bihar, India. Lower limbs which were having damaged veins were excluded from the study.

The skin is reflected from the medial side of lower limb to lateral side and course of GSV was traced in superficial dissection from its formation in front of medial malleolus at

ankle to its termination into femoral vein at saphenofemoral junction through saphenous opening. The tributaries and perforators were identified and dissected.

The Great Saphenous Vein and its tributaries and perforators were exposed and studied with reference an important landmark, i.e. from saphenofemoral junction. Various measurements were taken by using measuring taoe and thread. Variations of the GSV were noted and photographs were taken. A total of 13 parameters were taken each limb out of which 3 for Great Saphenous Vein, 5 for its tributaries and 5 for perforators of GSV. The measurements were repeatedly taken to ensure the accuracy.

The following parameters will be measured

- Limb Length (LL) – Distance from Anterior superior iliac spine (ASIS) to great toe.
- Great saphenous vein length (GSV L) – Distance from the formation of GSV i.e. from the commencement of marginal vein with dorsal venous arch till its termination into femoral vein at sapheno femoral junction.
- Midpoint of Inguinal Ligament (MIP) to sapheno femoral junction.

Tributaries of GSV

- Antero-lateral (AL)- Distance from saphenofemoral junction (SF Jn.) to the origin of antero-lateral tributary
- Postero-medial (PM) – Distance from saphenofemoral junction to the origin of postero-medial tributary
- Genicular
  (G) – Distance from saphenofemoral junction to the origin of genicular tributary
- Anterior arch vein (ARV) – Distance from saphenofemoral junction to the origin of anterior arch vein
- Posterior arch vein (PRV) – Distance from saphenofemoral junction to the origin of posterior arch vein

Perforators of GSV

- Adductor canal perforator (Add P) – Distance from saphenofemoral junction to the origin of Adductor canal perforator.
- Knee perforator (KP) - Distance from saphenofemoral junction to the origin of Knee perforator.
- Medial Ankle Perforator 1st (MAP 1) – Distance from saphenofemoral junction to the origin of 1st Ankle perforator.
- Media l Ankle Perforator 2nd (MAP 2) - Distance from saphenofemoral junction to the origin of 2nd Ankle perforator.
- Medial Ankle Perforator 3rd (MAP 3) - Distance from saphenofemoral junction to the origin of 3rd Ankle perforator.

All the measurements were taken in centimeters (cms). Observations were tabulated and analysed.

Result

In the Present study, out of 32 lower limbs (16 right and 16 left), some form of duplication of GSV was seen in 10 limbs (i.e. 31.25%). Maximum frequency of duplication was seen in ankle region i.e. 6 out of 10 limb (60%) followed by saphenofemoral junction in thigh i.e. 3 out of 10 limb (30%) and least in knee region i.e. 1 out of 10 limb (10%).

The mean distance and range of origin of tributaries and perforators of Great Saphenous Vein from Saphenofemoral junction is shown in Table 1 and Table 2.

Table 1: Mean and Range of distance of origin of tributaries of GSV from saphenofemoral junction

Parameters	Right ower limb		Left lower limb	
	Mean(cms)	Range(cms)	Mean (cms)	Range(cms)
LL	92.5	85-104	93.5	86-105
GSV L	92	87-100	91	81-100
MIP to SF Jn.	3.15	2-4.5	3.25	2-4.6
AL	10.5	5-25	16.25	4-42
PM	14.5	12.5-16.5	14.8	7-24
G	40.5	30-45	41.8	38-43.5
ARV	43.55	35-49	44.2	40.5-49
PAV	42.5	32.5-49.5	42.25	39-47

(LL-Lower limb, GSV L-Great saphenous vein length, MIP to SF Jn- Midpoint of inguinal ligament to saphenofemoral junction, AL-Anterlateral tributary, PM-Posteromedial tributary, G-Genicular tributary, ARV-Anterior arch vein, PAV-Posterior arch vein)

Table 2: Mean and Range of distance of origin of various perforators of GSV from saphenofemoral junction

Parameters	Right ower limb		Left lower limb	
	Mean(cms)	Range(cms)	Mean(cms)	Range(cms)
LL	92.5	85-104	93.5	86-105
GSV L	92	87-100	91	81-100
Add P	24.15	17-32	25.25	14-30
KP	38.15	32-45	35.25	26-45
MAP 1	85.5	75-92	81.8	79-93.5
MAP 2	86.5	78.5-93	83.8	76.5-93.5
MAP 3	87.55	81-95	79.2	75-93

(LL-Lower limb, GSV L-Great saphenous vein length, Add P-Adductor canal perforator, KP-Knee perforator, MAP 1-Medial ankle perforator 1, MAP 2-Medial ankle perforator 2, MAP 3-Medial ankle perforator 3).

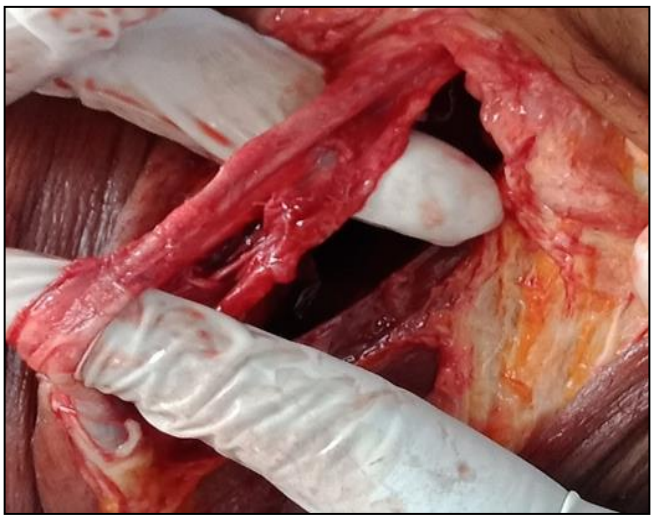

Fig 1: Termination of GSV in femoral vein at saphenofemoral junction

Fig 2: Formation of GSV with its medial ankle perforators

Fig 3: Variation of GSV with accessory saphenous vein

Fig 4: Normal pattern of GSV

Discussion

The present study deals with all the three aspects of GSV i.e. its tributaries, perforators and duplication was studied. The present study is a pioneer cadaveric study of GSV and would be great help to other researcher.

In the present study, duplication was found to be 31.25% in South Bihar population which was more on right slide than left side. As compared to Motwani *et al* who reported 8.9% incidence of duplication of vein in North Indian Population while the incidence of duplication was noted to be 20% in Iraq population by Hyathem and sayigh [8, 9]. Duplication in present stydy, was found maximum towards the ankle i.e 60% and the frequency of duplication was found to be least in knee region i.e. 10%. At saphenofemoral junction the frequency was found to be intermediate i.e. 30%.

Since the present study was cadaveric study and there are very few cadaveric studies on GSV, maximum researchers have used saphenogram of USG for the study of veins.

In the Salgado *et al* study, the above knee perforators were measured from medial epicondyle [10]. In 20 Limbs (50%) perforators were found at 6-8 cms from the medial epicondyle and in 24 limbs (60%) at 10-13 cm and in 28 limbs (70%) at 14-17 cms.

But in the present study instead of medial melleolus all the measurements were taken from saphenofemoral junction. According to which, the origin of adductor canal perforator was found to be in the range of 32-46 cms on right side and 26-44 cms on left side. The deep perforators which were found as below knee perforators from the medial malleolus at 5-9 cm, 10-14 cms, 20-24 cm are compatible with the cockett 1, cockett 2, cokett 3 and ‘’24 cm perforator’’ described in available literature [11, 12]. In Salgado *et al* study, deep perforators were found to be the range of 15-19 cms in 30% cases.

In the present study, knee perforators are found to be in the range of 32-45 cms on right side and on left side it is 26-45 cms. Ankle perforators are measured form saphenofemoral junction i.e 1st, 2nd and 3rd perforator at 75-92 cms, 78.5-93 cms and 81-95 cms on right side and from 79-93.5 cms, 76.5-93.5 and 75-93 cms on left side.

Several authors have studied various variations in the formation, course and tributaries of the saphenous vein but no studies have been done on the measurements of the origin of tributaries of GSV. [13,14] In the present study, we have taken saphenofemoral junction as a landmark and the origin of various tributaries were found to be i.e. of antero-leteral tributary, postero-medial tributary, genicular tributary, anterior and posterior arch vein tributaries in the range of 5-25 cms, 12.5-16.5 cms, 30-45 cms, 35-49 cms and 32.5-49.5 cms on right side and 4-42 cms, 7-24 cms, 38-43.5 cms, 40.5-49 cms and 39-47 cms on the left side as observed in Table 2.

Variations in the pattern of duplication of GSV would be of great help in planning varicose vein treatment and consequent operative interventions. Since, GSV is used as an auto graft for coronary artery bypass procedures. Therefore, a knowledge of duplication of GSV and the various measurements that of origin of tributaries and perforators of GSV that we have done from saphenofemoral junction will be helpful for surgeons, cardiologists and interventional radiologists.

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