

# Clinico-Anatomical and Radiological Correlation of Varicose Veins of Lower Limb – A Cross-sectional Study

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## ABSTRACT

**Introduction:** Duplex Doppler evaluation of lower limb veins was performed to evaluate the pattern of involvement of various level of incompetence in Indian patients with varicose veins. A prospective In this study, we evaluated the frequency and risk factors for different types of varicose veins of lower limb using Doppler ultrasound.

**Material and Methods:** Doppler study of 50 patients presenting with varicose veins coming for evaluation to our Radiology department of S.C.B. Medical College was done. The clinico-etiological-anatomical and pathological (CEAP) classification was applied for assessment. The site of incompetency particularly Sapheno-femoral, Sapheno-popliteal junction and the perforators assessed to find the most commonly encountered incompetency. During the year 2017, over a period of 12 months, 60 cases of varicose veins of lower limb were evaluated by using Doppler ultrasound. Frequency distribution and descriptive statistics of the various types of varicose veins of lower limb were analysed.

**Results:** Varicose veins were commonly observed in the age group 30-50yrs (52%) and less common in the age group 10-20 yrs (4%). It was seen more common unilaterally 32 cases (64%) than bilaterally 18 cases (36%). In this study the commonest clinical presentation is complaint of dilated, tortuous swellings/varicose veins in the lower limb.

**Conclusion:** Patients with varicose veins and chronic venous disease, have varying degrees of incompetence and Color Doppler is very useful in identifying the distribution and extent of reflux in these patients.

**Keywords:** Varicose Vein, Sapheno-Femoral Junction, Sapheno-Popliteal Junctions, Perforators

## INTRODUCTION

Varicose veins are defined as a combination of permanently elongated and dilated veins whose path has become tortuous, inducing pathological circulation and are a common complaint in the lower limb that can take many forms, ranging from a non-pathological circulation to an invalidating chronic disorder. The venous anatomy of the lower limbs is highly variable because of venous malformations that occur during later development of the embryo, particularly during the final phase of embryogenesis. It is believed that a generalized defect of the mesoderm can cause vascular abnormalities, such as agenesis of deep veins. Venous malformation is the most common congenital vascular disorder and is generally a single lesion. However, in 15-20% of cases it will present as a mixed lesion, combined with other congenital vascular malformations, such as lymphatic and arteriovenous malformations.

The femoral vein may be duplicated partially or throughout its entire length. Occasionally it will pass through the adductor canal, above the femoral artery, running parallel to it until it joins the deep vein, forming the common femoral vein. Various categories of malformations of the femoropopliteal venous segment has been described such as agenesis, multiplications, isolated femoral vein, isolated popliteal vein, high junction of the tibial veins.

Varicose veins cause a great deal of morbidity in our population today.<sup>1</sup> It is a very common problem affecting 15% of men and 25% of women of general population in western studies.<sup>2</sup> However its prevalence in general Indian population is not known. Assessment with duplex Doppler will give the distribution and degree of incompetency and hence helpful in the treatment.

## MATERIAL AND METHODS

This was a cross sectional study was carried out on 60 patients presented with varicose veins to the tertiary care hospitals. Out of them 10 cases presenting with superficial thrombophlebitis, deep venous thrombosis were excluded from the study. We studied all the cases using Doppler ultrasound. Sample size being 50 patients. This study was conducted over a period of one year during 2017. Patient data collection forms were used to collect data on age, sex, educational status, occupational status, time of occurrence and adverse personal habits like Tobacco abuse (smoking, chewing, snuff), alcohol abuse. The study was performed with Philips HD-7 ultrasound machine with 10MHZ transducer using grey scale, colour and spectral Doppler. The patients were examined in the standing position while supporting their weight on the contra lateral extremity. Entire surface of lower limb was examined.

## RESULTS

We conducted the study on 60 patients presented with

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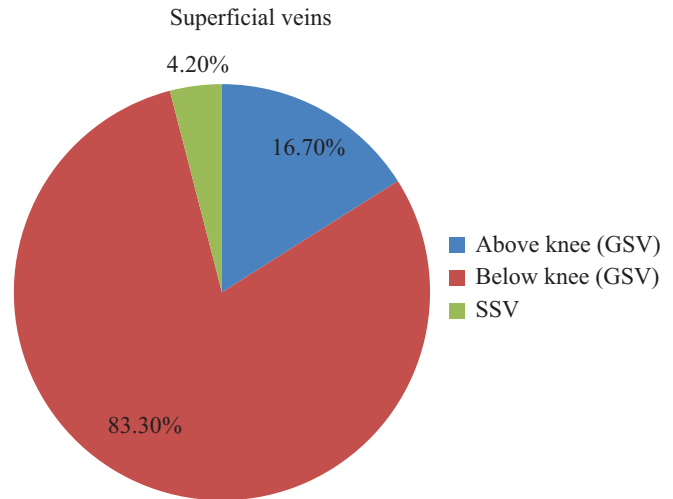
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	Isolated SFJ incompetence	Isolated SPJ incompetence	Both SFJ and SPJ incompetence
Unilateral	23	14	12
Bilateral	19	8	

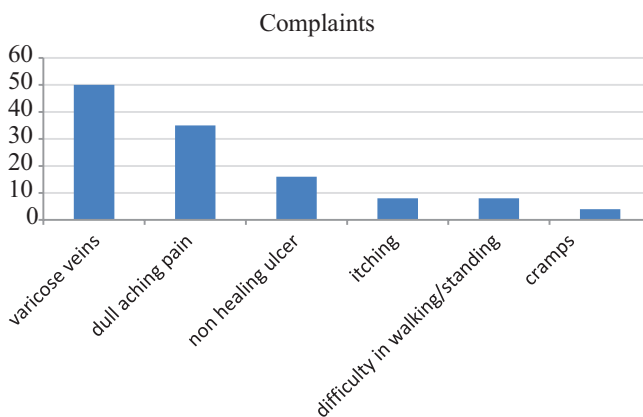
**Table-1:** Shows incidence of Isolated SFJ and SPJ incompetence

Location	Numbers
Above knee (dodd's and hunter)	4
Below knee medial upper third (boyd's perforators)	5
Below knee medial mid third (cocket's)	8
Below knee medial lower third	4
Posterior leg	2
Lateral leg	1
Anterior leg	0

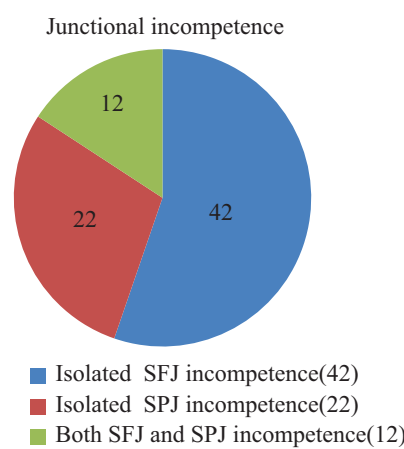
**Table-2:** Distribution of incompetent perforators



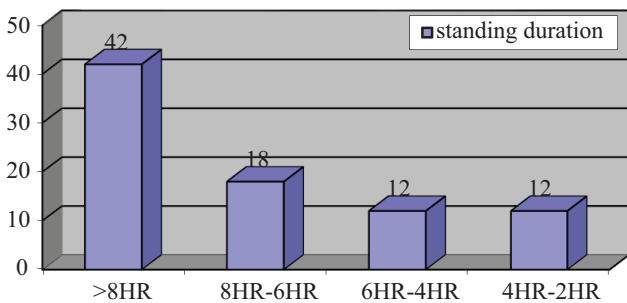
**Graph-4:** Show incidence of location of superficial veins



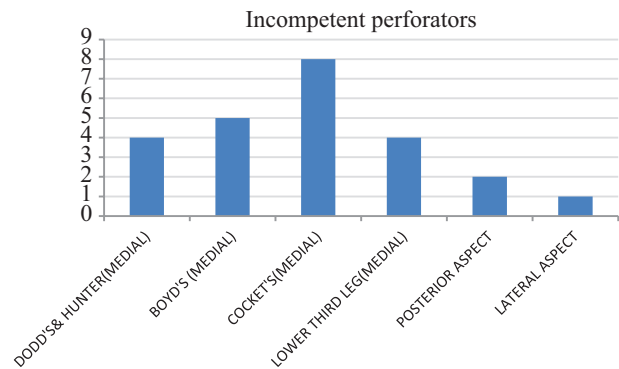
**Graph-1:** Shows types of presentation of varicose vein patients



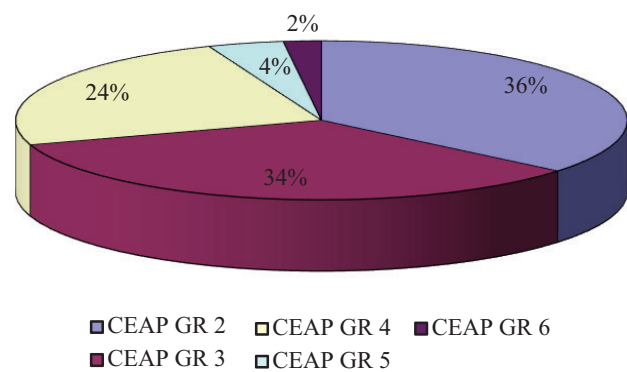
**Graph-5:** Shows Junctional incompetence



**Graph-2:** Shows association of varicosity to standing duration



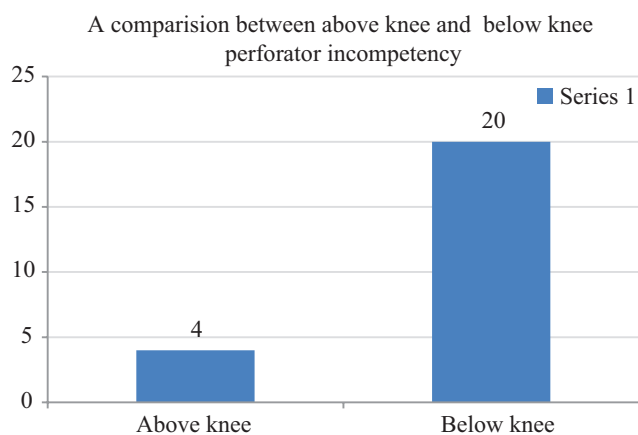
**Graph-6:** Shows types of incompetent perforators



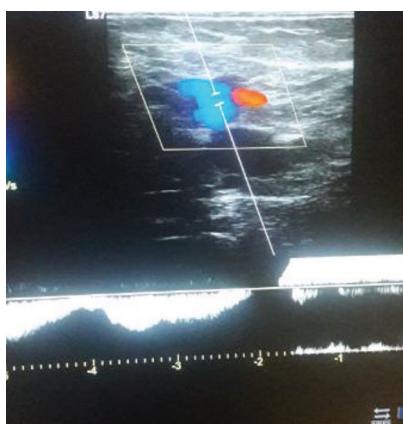
**Graph-3:** Shows different CEAP grades

varicose vein. Out of them 10 cases were excluded based on exclusion criteria. Among the cases studied 86% (43)

were males and 14% (7) were females. Varicose veins were commonly observed in the age group 30-50yrs (52%) and less common in the age group 10-20 yrs (4%). It was seen more common unilaterally in 32 cases (64%) than bilaterally in 18 cases (36%). Including both unilateral and bilateral cases a total of 36% cases had left lower limb and 28% had right lower limb involvement. In this study the commonest clinical presentation is complaint of dilated, tortuous swellings/varicose veins in the lower limb. In our study we observed 70% of patients presented with dull aching pain, 32% with complaint of leg ulcer and 8% with night cramps



**Graph-7:** Shows comparison between above knee and below knee perforator incompetency



**Image-1:** Sapheno-femoral junction showing reversal flow during valsalva



**Image-2:** Sapheno-femoral junction showing reflux during valsalva

(8%). (Graph -1)

In this study it was seen that the majority who developed varicose veins had history of long standing hours. 21 (42%) out of 50 patients stood in their jobs for more than 8 hours and 9 (18%) of patients for more than 6 hours. (Graph -2)

The diseased leg was clinically examined, patient's symptom was recorded and patient assigned to different CEAP grades. (Graph -3). C- clinical condition, E- etiology, A –anatomic location, P- pathophysiology.

Grade 2-no.patients (18)

Grade-3-no.patients (17)



**Image-3:** Dilated superficial vein with perforators(Grey scale)



**Image-4:** Dilated superficial vein (Grey scale)

Grade 4-no.patients (12)

Grade 5 –no. patients (2)

Grade 6- no. patients (1)

There are 33 limbs with CEAP grade 3, 23 with grade 4, 4 with grade 5, 2 with grade 6. We did not have any patients with grade 1. 98% of patients had primary etiology out of which only 1 patient had a positive family history of varicose veins in first blood relations. One patient was labelled under congenital etiology. And only 1 patient had underlying demonstrable deep vein thrombosis, hence came under secondary etiology which was only 2%. The diameter and cross-sectional areas of femoral vessels (common femoral artery and vein) were measured at the level of SFJ in the groin. Similar measurements of the popliteal vessels were done in the popliteal fossa. Great Saphenous vein diameter was recorded at seven sites in the limb, (three in thigh, three in the leg and one in the foot) and the total calculated.

Incompetency at Sapheno-femoral junction, Sapheno-popliteal junction and level perforators were evaluated under colour Doppler and spectral mode with valsalva manoeuvre. Superficial venous reflux in some form was seen in all 100 limbs. 100% at junctional sites (Sapheno-femoral or Sapheno-popliteal junctions) and at the perforators. Sapheno-femoral junction was incompetent in 54 limbs (54%). Unilateral SFJ incompetence was noticed in 23 limbs and bilateral in 19 limbs. And 12 limbs had both SFJ and SPJ incompetence. Isolated sapheno-popliteal incompetence was found in 22 patients. Out of 100 limbs that did not have

junctional incompetency, 24 limbs had isolated perforator incompetence. (Table – 1)

The lower limb was divided into different areas and the number of perforators in these areas was recorded. (Graph -6) The maximum number of perforator was found in medial aspect of leg. Another common area of significant number of perforators was in posterior aspect of leg in the upper half where an incompetent perforator was identified connecting gastrocnemius vein to the short saphenous vein. (Table-2) Isolated perforator incompetence was present in 24 limbs. (Graph -5)

## DISCUSSION

According to the prevalence of occurrence, Davy A et al<sup>3</sup> in their epidemiological studies showed, three zones such as 1) a zone of great varicose occurrence (Western Europe, North America); 2) a zone of mild occurrence (Black Africa, the Far East, the Third World in general); and 3) zones showing discrepancies, (South America, the Mediterranean Basin, India). Although many studies has been done on this topic around the globe but there are no major studies done in Indian population. The exact prevalence of the disease in general Indian population is unknown. However, it is a significant problem affecting a large number of patients and causing long-standing morbidity. Malhotra SL et al<sup>4</sup> in their survey on 323 men from Madras in the South and 354 men from Ajmer in the North of India to determine the prevalence of varicose veins among railway sweepers, showed that the overall prevalence was 25.08% in South Indian and 6.8% in North Indian sweepers.

Although most acute venous problems are concerned with obstruction by thrombosis, most chronic venous problems are caused by reflux. Reflux is defined as retrograde flow of blood in the veins caused by absent or incompetent valves. The failure of check valves in the perforating veins, in particular, allows high pressures (upto 250 mmHg) generated in the deep veins by muscular contraction to be transmitted directly to the unsupported superficial veins. The resultant venous hypertension is associated with skin pigmentation, lipodermato sclerosis and ulceration.

Of the various diagnostic tests for detection and assessment of venous reflux, recently, color flow Doppler scanning is considered the gold standard for non-invasive anatomical and functional assessment of venous reflux.<sup>5</sup> We have studied all our patients with 2D ultrasound, color and spectral Doppler. Although, there are different methods described to elicit and measure the venous reflux, we used the Valsalva maneuver because of ease of performance.<sup>6,7</sup>

In this study we had observed varicose veins more in male patients in compare to females (43 and 7). In contrast to us Callam MJ et al<sup>2</sup> and Evans CJ et al<sup>9</sup> described a higher prevalence of varicose veins in women in compare to man. Cohen J et al described higher incidence of varico veins in women may be due to hormonal factors. This higher incidence of varicosities in male in our study could be due to lesser number of affected Indian women seeking medical help.

We found varicose veins more on the left sided limbs (59 limbs) than the right sided limbs (41 limbs). We analysed this could be related to the left iliac artery crossing the left iliac vein. However, Evans CJ<sup>10</sup> studies shows equal involvement of right and left lower limbs.

We observed association superficial venous reflux at the junctional sites or in the perforators in most of the cases. We studied incompetent perforator veins in 96% of cases. Isolated incompetent perforator veins were observed in 24 limbs (24%). Most of the perforators were found in the medial aspect of the leg as described in literature. However, we found another common site in the upper half of posterior leg between the gastrocnemius vein and the short saphenous vein. Average number of incompetent perforators was 2 to 3. We studied sapheno-popliteal junction incompetence in 34% of limbs. The classical clinical teaching is that, in saphenopopliteal junction incompetence, dilated superficial veins are seen in lateral aspect of leg. But, we found SPJ incompetence in 5 of the 22 limbs and it was observed that the short Saphenous vein decompressed into the great saphenous vein via dilated communicating veins and short saphenous vein beyond these communicating veins was not dilated. In these cases, SPJ incompetence could be clinically missed and could be a cause for post operative recurrence.

There was no statistically significant correlation between the relative size of the deep veins compared to the corresponding arteries and the amount of reflux or dilated intramuscular calf veins and the deep venous reflux. This indicates that the dilatation of the deep venous system could be associated with certain other factors, not necessarily due to the reflux. The reflux circuit theory of venous overload suggests that deep veins can be dilated due to increased re-entering blood flow into the deep venous system due to superficial venous incompetence.<sup>14</sup>

We found statistically significant correlation between the diameter of great Saphenous and short saphenous veins and duration of reflux at SFJ and SPJ respectively. Though we observed junctional reflux in most of the cases of varicose veins, there was no statistically significant correlation between the duration of junctional venous reflux and clinical severity of chronic venous disease. However, significant correlation was observed between the clinical severity of disease and number of incompetent perforators. Similarly Stuart WP et al<sup>15</sup> and Labropoulos N et al<sup>16</sup> observed significant correlation between the clinical severity of disease and number of incompetent perforators.

In this study we found most of the anatomical variations in the popliteal fossa region at the drainage site of SSV. They were seen in 36% of cases including variable drainage of SSV in 34%, two sapheno-femoral junctions with two GSV in 1% and an unnamed perforator with dilated unnamed superficial vein in the popliteal fossa in 1% of cases.

Dilated deep veins in the calf muscles was was 1 ½ times more frequently seen in association with deep venous reflux. This may be due to more stasis of the blood in calf veins in affected limbs with reflux. However, this particular finding has not been mentioned in the literature, though it is a

frequently observed finding.

## CONCLUSION

In conclusion, patients with varicose veins and chronic venous disease, have varying degrees of deep, superficial, and perforator valvular incompetence; combined multiple site incompetence being the commonest pattern. Color Doppler is very useful in identifying the distribution and extent of reflux in these patients for complete diagnosis as well as preoperative mapping of incompetent sites so that the surgery is targeted at the sites of incompetence.

## ABBREVIATIONS

1. CEAP grades – C- clinical condition, E- etiology, A – anatomic location, P- pathophysiology
2. SFJ – Sapheno-femoral junction,
3. SPJ – Sapheno-popliteal junctions
4. GSV – Great saphenos vein
5. SSV - Small saphenos vein

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