

## ROLE OF COLOUR FLOW DUPLEX SONOGRAPHY IN EVALUATION OF VARICOSE VEINS OF LOWER LIMBS

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### ABSTRACT

#### BACKGROUND

Varicose veins are dilated, tortuous veins mainly involving the superficial veins of lower limb. Depending on the presence or absence of the underlying cause, they are classified as primary and secondary. Colour Doppler / duplex scanning is a widely available non-invasive modality used for the evaluation of varicose veins. In this study, we evaluated the role of Doppler ultrasound for the evaluation of varicose veins and determine the cause where ever feasible.

#### MATERIALS AND METHODS

The study is a prospective study of 50 patients referred with signs and symptoms of varicose veins to the department of Radiodiagnosis at Katuri Medical College, Chinakondrupadu, between January 2016 and October 2017, for a period of 21 months.

#### RESULTS

A total of 42 (50%) cases were studied with colour duplex doppler of which 21 (42.86%) cases were primary, and 18 secondary to DVT and 3 (7.14%) congenital.

#### CONCLUSION

Colour duplex assessment of peripheral veins provides an adequate and rich information, both the anatomical and physiological information. Doppler imaging is non-invasive, radiation free, hassle free modality for examining the venous system, particularly with respect to the diagnosis of thrombus and chronic venous insufficiency particularly in symptomatic patients.

#### KEYWORDS

Colour Duplex Doppler, Lower Limb, Varicose Veins, DVT, Chronic Venous Insufficiency.

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#### BACKGROUND

Varicose vein is a term usually described for dilatation of the superficial saphenous veins because of reflux in veins due to absent or dysfunction of the valves, which occurs generally in lower limbs because of their dependant position.<sup>1</sup> Varicose veins are dilated, swollen, tortuous twisted veins on the skin especially the calf region.<sup>2</sup> By definition a vein is varicosed if it is dilated tortuous and lengthened. In majority of the cases (upto 70%) the cause is not known and are Primary. Secondary varicose veins are due thrombus which may be superficial or deep in location.

Duplex doppler not only helps in determining the cause but opens a window for real time evaluation of the function

of the valves which are key in the aetiopathogenesis of varicose veins. Prior to the advent of ultrasound and colour doppler clinical examination and invasive venography or varicography were main stay in the evaluation of patients with varicose veins.

Ultrasound and colour duplex provide a safe, non-invasive, radiation free, widely available modality in the evaluation of patients with varicose veins. Ultrasound also helps in guiding the interventional treatment including the sclerotherapy and laser ablation which are less invasive compared to surgical treatment.

#### Aims and Objectives

1. To evaluate the range of different imaging findings on colour duplex ultrasound in patients who are referred with signs & symptoms of varicose veins and chronic venous insufficiency.
2. To identify the patients of DVT with deep venous reflux as a cause of varicose veins.
3. To describe the anatomical variants of venous anatomy and perforators of lower limbs in patients with varicose veins.

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**MATERIALS AND METHODS**

- Prospective study of 50 patients referred with signs and symptoms of varicose veins to the department of Radiodiagnosis at Katuri Medical College, Chinakondrupadu between January 2016 and October 2017, for a period of 21 months.

The study has been done using Philips Envisor CHD machine and GE Logiq machine.

Frequency probes used – 5MHz and 3.5MHz.

**Inclusion Criteria**

Cases of varicose veins referred for colour doppler sonography.

**Exclusion Criteria**

1. Pregnant ladies.
2. Severe obesity.
3. Any chronic severe disease.

**RESULTS**

A study of 50 patients with signs and symptoms of varicose veins in the lower extremities was done. The following observations were made.

Sex	Cases Suspected with Varicose Veins Number (%)
Male	38 (76%)
Female	12 (24%)
Total	50 (100%)

**Table 1. Sex Distribution**

Male predominance was found in our study. Of the 50 patients 38 (76%) were males and 12 (24%) were females.

Age Group in Years	Cases with Suspected Varicose Veins Number (%)
11- 20	2 (4%)
21-30	6 (12%)
31-40	11 (22%)
41-50	15 (30%)
51-60	9 (18%)
61-70	7 (14%)
Total	50 (100%)

**Table 2. Age Distribution**

Age of the patients ranged from 19 to 68 yrs. 62% of the patients were older than 40 years.

Symptoms	Cases Suspected with Venous Insufficiency (%)
Swelling	16 (32%)
Varicosity	12 (24%)
Pain	8 (16%)
Ulcer	7 (14%)

Varicosity and Swelling	3 (6%)
Varicosity and Pain	2 (2%)
Eczema	2 (2%)
Total	50 (100%)

**Table 3. Distribution of Cases by Symptoms**

We found that swelling (32%) was the most common presenting symptom, followed by varicosity (24%) as the second most common presenting symptom.

	No. of Cases (%)
Positive Doppler	42 (84%)
Normal Doppler	08 (16%)

**Table 4: Doppler Ultrasound Findings**

Of the total 50 cases, positive Doppler was noted in 42 cases. 8 cases showed normal Doppler study.

	No. of Cases (%)
Unilateral	38 (90.48%)
Bilateral	4 (9.52%)
Total	42 (100%)

**Table 5. Type of Involvement in Study Population with Evidence of Varicose Veins**

Our study showed unilateral predominance (90.48%).

Extremities	Number of Cases (%)
Unilateral	
Right	12 (28.58%)
Left	26 (61.90%)
Bilateral	4 (9.52%)

**Table 6. Side of Involvement of the Veins in Patients with Varicosity**

Left lower extremity predominance is noted in our study (61.90%) and bilateral involvement in 4 cases.

Factors	Cases with DVT n= 18 Number (%)	Cases with Other Causes of Varicosities n= 24 Number (%)
Prolonged Hospitalization	5 (27.8%)	-
Trauma	3 (16.7%)	3 (12.5%)
Surgery	2 (11%)	-
Occupational	1 (5%)	8 (33.33%)
Hereditary	-	5 (20.8%)
No Known Predisposing Factor	8 (44.44%)	8 (33.33%)

**Table 7. Predisposing Factors**

Thus, prolonged hospitalization 5 (27.8%) and trauma 3 (16.7%) were the most common factors in patients with DVT. Occupational/ prolonged standing were common in 8 (33.33%) and hereditary factors 5 (20.8%) in other causes of varicosities.

	CFV	SFV	PV	ATV	EIV	CIV	SVS
No. of cases showing involvement	11	13	8	4	4	1	7
Percentage of cases showing involvement	61.11	72.22	44.44	22.22	22.22	5.56	38.89

**Table 8. Distribution of the Veins in Patients with Thrombi**

Causes	Number (%)
Primary	21 (50%)
Secondary to DVT	18 (42.86%)
Congenital	3 (7.14%)
Total	42 (100%)

**Table 9. Aetiological Classification of Varicosity in Patients Showing Reflux (with Doppler Study)**

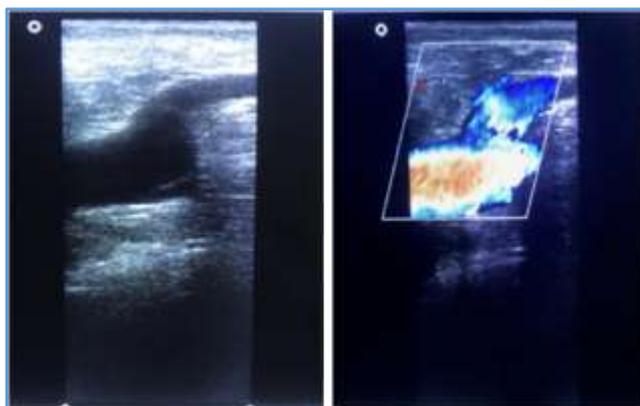
In our study primary varicosities predominated - 21 cases (50%). Varicosities secondary to DVT were seen in 18 cases (42.86%), congenital causes were rare and was noted in 3 cases (7.14%) of the total positive doppler study.

Segments	Bilateral Extremities	Unilateral Extremities	
		Right	Left
SFJ	1	6	11
SPJ	1	3	5
Perforator Incompetence			
AK	1	1	0
BK	1	9	10
MC	2	4	14
AA	3	4	13

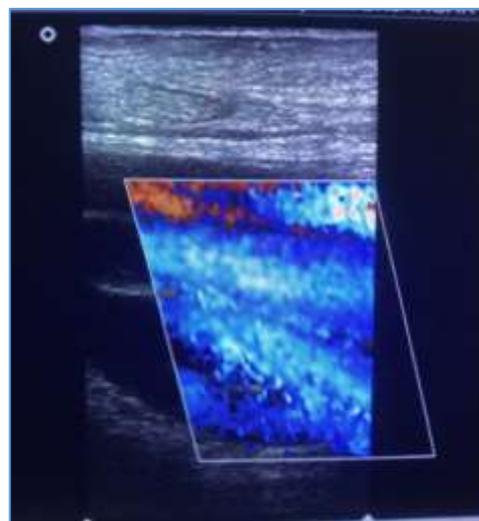
**Table 10. Distribution of Incompetent Veins**

(These include both primary and secondary varicosities)

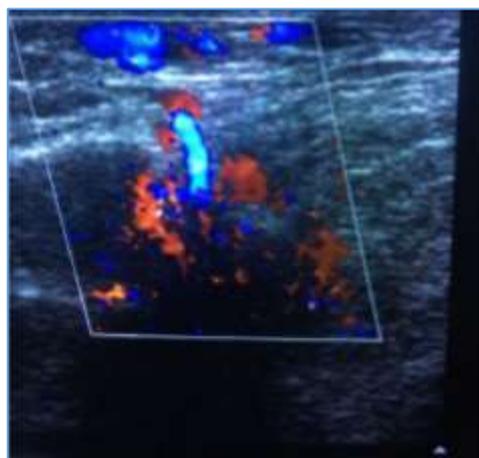
GSV varicosity predominated in our study. SFJ incompetence was commonly noted in our study (18 cases). SPJ incompetence was noted in 9 cases. Perforator incompetence was seen in 31 cases, with below knee, mid-calf and above ankle perforators showing equal incidence (20 each).



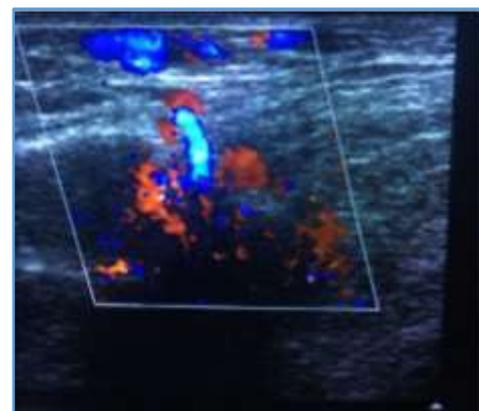
**Figure 1. Grey Scale and Colour Doppler Images showing Normal SFJ**



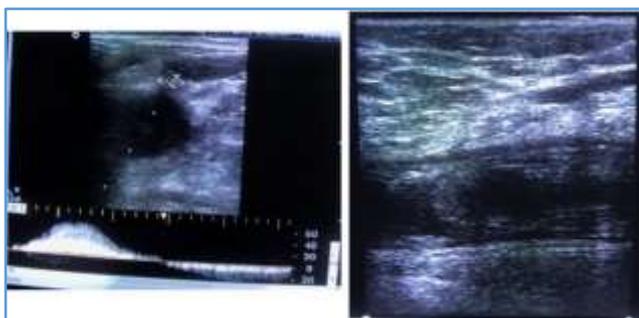
**Figure 2. Colour Doppler Image showing Normal SFA, SFV, Profunda Femoris Vein**



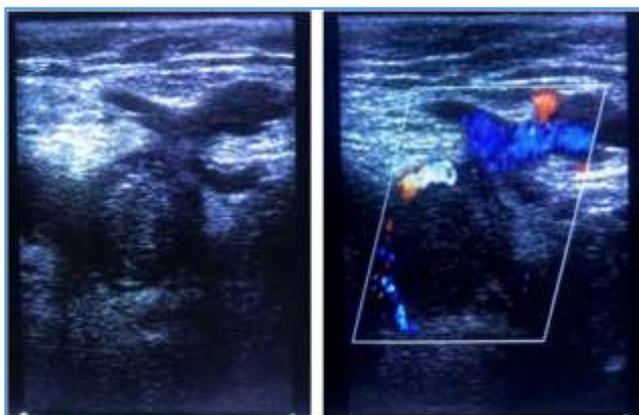
**Figure 3. Colour Doppler Image showing Varicosities along GSV**



**Figure 4. Colour Doppler Image Showing Perforator**



**Figure 5. (i) Transverse Scale Image Showing Thrombus in SSV. (ii) Sagittal Grey Scale Image showing Thrombus in CFV**



**Figure 6. Axial Grey Scale and Colour Doppler Images showing Thrombus in CFV**



**Figure 7. Colour Doppler Image showing Thrombus in Popliteal Vein**

## DISCUSSION

The peripheral veins may be affected by a variety of disorders which can be assessed by the ultrasound. In addition to the venous thrombosis and other veno-occlusive diseases the evaluation of varicose veins and pre-operative varicose vein mapping by doppler evaluation are common.<sup>3,4,5</sup> The present study was performed to assess the role of colour flow duplex sonography in evaluation of varicose veins. It included assessment of valvular incompetence, detection of thrombus and extent of its involvement, characterization of the varicosities as primary

or secondary to underlying DVT – thus helping to ensure safe and effective treatment. Among the 50 cases studied for suspected venous pathology, colour flow duplex sonography showed positive findings in 42 cases; and 8 cases had normal findings. Thus, doppler was effective in excluding other causes of pain and swelling, thus preventing unnecessary interventions and medical therapy.<sup>6</sup>

## Age

The range of age of patients with venous abnormalities in our study was 11-70 years. We studied a total of 50 patients, of which 42 were detected to have venous abnormalities; the study group which showed maximum incidence was in the age group of 41-50 years, 15 cases (30%). Out of the total 50 cases, 31 cases (62%) were more than 40 years.

In a randomized trial by Belcaro G et al (2002), it was observed the venous abnormalities increased with progressing age.<sup>7</sup> Different studies reported the highest rate of recurrence in the age between 40 and 49 and the least age was 20-29 years.

## Sex

Males contributed the major group 38 (76 %) in our study with suspected venous abnormalities and they also had a higher incidence 33 (78.57 %) of positive Doppler study. In our study out of the total 50 cases, 12 (24 %) are females with 9 (75%) showing doppler features of varicose veins. These findings correlate well with the study done by Strandness et al (1983)<sup>8</sup> in which they showed a higher incidence of chronic venous insufficiency in males. In their study 66 % of the male patients had a positive study.

## Type of Involvement

In present study venous abnormalities were more common in left extremity. 26 cases i.e. 61.9% of the positive cases showed left side involvement, 12 (28.58%) showed right side involvement and bilateral involvement was found in 4 (9.52%). This is in correlation with the study conducted by Cockett, Niges and Thomas (1976)<sup>9</sup> who showed that the venous abnormalities were more common in the left Extremity. This may be due to the crossing over of left common iliac vein by right common iliac artery, giving rise to prolonged venous stasis.

## Symptoms

The symptoms that prompted for Doppler examination were swelling in 16 (32%) patients, varicosity in 12 (24%), pain in 8 (16%), ulcer in 7(14%), Varicosity and swelling in 3 (6%), varicosity and pain in 2 (4%) and eczema in 2 (4%) patients. In cases showing venous abnormalities; swelling (32%) and varicosity (24%) were the predominant symptoms. Among the 18 patients showing evidence of DVT the most common symptom was swelling (55.56%), next most common symptom was venous ulcer (38.89%).

## Distribution of Varicosities

This includes both primary and secondary varicosities involving 40 patients whose Doppler findings were

suggestive of varicosities. 25 patients had left sided involvement, 12 right sided involvement; 3 patients had bilateral involvement. Varicosities along GSV predominated in our study, 30 cases (75%); and along SSV 14 cases (35%) were noted. Saphenofemoral junction incompetence was commonly noted in 18 (45%) of our cases. Out of the 18 cases of SFJ incompetence, 15 cases showed incompetence associated with dilation of superficial venous system. SPJ incompetence was noted in 9 (22.5%) cases of which 6 cases showed associated dilation/ varicosities of short saphenous vein.

### Localisation and Extent of Thrombosis

Colour Doppler ultrasound helps in exact localization of the thrombus. In the present study thrombosis was localized to thigh or popliteal region in 15 (83.33%) of the total 18 cases of DVT. These findings correlate well with the study by Hill SL et al (1997)<sup>10</sup> where 49% thrombi was within the segment of thigh or popliteal region without calf involvement. The distribution of thrombi in the present study are as follows- 5.56% in CIV, 22.22% in EIV, 61.11% in CFV, 72.22% in SFV, 44.44% in PV, 22.22% in ATV, 0% in PTV and 38.89% in the Superficial veins

### CONCLUSION

Lower limb venous system pathology is a common occurrence, and clinically presents either as DVT or as venous insufficiency situation which may be associated with considerable morbidity and mortality.

Colour duplex assessment of peripheral veins provides an adequate and rich information, both the anatomical and physiological information. Doppler imaging is non-invasive, radiation free, hassle free modality for examining the venous system, particularly with respect to the diagnosis of thrombus and chronic venous insufficiency particularly in symptomatic patients. Colour Doppler can be used as a sole investigative modality instead of venography in many cases and may be the only examination required to define the anatomy and haemodynamic assessment in patients with varicose veins.

Varicography demonstrates the venous perforators which are obviously incompetent but doppler ultrasound has the additional advantage that the segments of deep and superficial systems can be imaged and the direction of blood flow within each segment can be assessed. Compared to other modalities like contrast enhanced CT and MRV, Colour Doppler is much cheaper, reasonably accurate and much more widely available.

It was of immense importance and utility with respect to the following:

1. To differentiate between obstruction and valvular incompetence.
2. Accurate clot localisation in cases with diagnosis of DVT.
3. Evaluation of the extent of thrombosis.
4. To define the location and extent of valvular dysfunction.
5. Easily evaluate the competence of SFJ and SPJ valves. To distinguish whether saphenous vein is involved and whether the involvement is confined to the venous tributaries or perforators.
6. Depicting anatomic variations, collaterals.
7. Excluding other causes of pain and swelling of lower limbs.
8. To confirm the diagnosis of valvular incompetence and venous insufficiency due to primary venous pathology or secondary to underlying DVT; and thus, to ensure safe and effective therapy.

### REFERENCES

- [1] Polack JF, Culter SS, O'Leary DH. Deep veins of the calf: assessment with colour Doppler flow imaging. *Radiology* 1989;171(2):481-485.
- [2] Foley WD, Middleton WD, Lawson TL, et al. Colour Doppler ultrasound imaging of lower-extremity venous disease. *AJR* 1989;152(2):371-376.
- [3] Callam MJ. Epidemiology of varicose veins. *Br J Surg* 1994;81(2):167-173.
- [4] Sakurai T, Gupta PC, Matsushita M, et al. Correlation of the anatomical distribution of venous reflux with clinical symptoms and Venous haemodynamics in primary varicose veins. *Br J Surg* 1998;85(2):213-216.
- [5] Allan PL. Doppler ultrasound in medicine part and clinical applications. *Hospitals Update* 1992:254-262.
- [6] Zweibel WJ, Pellerito JS. Introduction to vascular ultrasonography. 5<sup>th</sup> edn. Philadelphia, PA: Elsevier Saunders 2005.
- [7] Cesarone MR, Belcaro G, Nicolaidis AN, et al. 'Real' epidemiology of varicose veins and chronic venous disease: the San Valentino Vascular Screening Project. *Angiology* 2002;53(2):119-130.
- [8] Strandness DE, Langlois Y, Cramer M, et al. Long term sequelae of acute venous thrombosis. *JAMA* 1983;250(10):1289-1292.
- [9] Dodd H, Cockett FD. The pathology and surgery of the veins of the lower limb. 2<sup>nd</sup> edn. New York: Churchill Livingstone 1976.
- [10] Hill SL, Holtzman GI, Martin D, et al. The origin of lower extremity deep vein thrombi in acute venous thrombosis. *Am J Surg* 1997;173(6):485-490.