

Role of Colour Flow Duplex Sonography in Evaluation of Chronic Venous Insufficiency in Lower Limbs

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How to cite this article: Mohammed Abdul Azhar. Role of colour flow duplex sonography in evaluation of chronic venous insufficiency in lower limbs. *International Journal of Contemporary Medicine Surgery and Radiology*. 2017;2(3):80-84.

A B S T R A C T

Introduction: DVT of the lower extremity is one of the most common cause of pulmonary embolism which in turn is responsible for majority of the deaths. Study aimed to evaluate the spectrum of findings on colour duplex ultrasound in patients who present with clinical symptoms and signs of chronic venous insufficiency. To identify patients who can be taken up for varicose venous surgery without any risk of pulmonary embolism by ruling out deep vein thrombosis.

Materials and methods: it is prospective study done in 50 cases who are with all clinically suspected cases of venous disease of the lower limb, referred to the department of radiodiagnosis were evaluated. All patients underwent a detailed colour duplex ultrasound of the lower limb venous system.

Results: most common age group was 41-50 yrs (12 patients, 24%) male preponderance was observed. (41 patients, 82%), Left (23 patients, 46%) lower being more affected than right (16 patients, 32%) or bilateral (11 patients, 22%). Among the 50 patients examined, 43 (86%) of them had chronic venous insufficiency, 4 (8%) had cellulitis and 3 (6%) had baker's cyst. Of the patients with chronic venous insufficiency, 7 (16.3%) patients had acute DVT. the remaining 36 (83.7%) patients had varicose veins. In 46 limbs with varicose veins, 27 (58.7%) cases had GSWV varicosities, 1 (2.1%) had SSV varicosities and 18 (39.2%) had involvement of both GSV and SSV. Perforator incompetence (58.7%) was the most cause for varicosities below knee medial mid 1/3 perforators (69.5%) were found to be the most common incompetent perforators. All the 7 patients with deep vein thrombosis showed involvement of the proximal segment veins. Among the 36 patients varicose veins, 20 of them underwent surgery after preoperative mapping of the venous system. 19 (95%) of the patients were in agreement with the surgical finding.

Conclusion: Colour flow duplex sonography is an accurate investigation in demonstrating the various spectrum of findings in a patients with CVI, and also has a high percentage correlation with operative finding.

Keywords: Colour Flow Duplex Sonography, Chronic Venous Insufficiency, Lower Limbs

INTRODUCTION

The term chronic venous insufficiency refers to the venous valvular incompetence in the superficial, deep and/or perforating veins. Incompetence of the vein valves permits reversal of flow and promotes venous hypertension in the distal segments.¹ This form of venous dysfunction may be the result of recanalization of thrombosed venous segments, pathological dilatation of the vein or due to congenital absence of competent valves. Chronic venous insufficiency of the lower limbs (CVI) is characterized by symptoms or signs produced by venous hypertension. symptoms may include aching, heaviness, leg-tiredness, cramps, itching, sensations of burning, swelling, the restless leg syndrome, dilatation or prominence of superficial veins, and skin changes. Signs may include telangiectasia, reticular or varicose veins, edema, and skin changes such as pigmentation lipodermatosclerosis, eczema, and ulceration. Varicose veins are the most

common manifestation of CVI. It is believed that they are usually due to abnormal dispensability of connection without previous thrombosis. Secondary varicose veins are caused by valvular damage after vein thrombosis (DVT) and recanalization that gives rise to incompetent deep and perforating vein.

Deep vein thrombosis can cause pain and swelling of the affected limb and it may also cause structural damage to the valves of the deep veins, which results in post phlebitis syndrome.² The clinical signs and symptoms of deep venous thrombosis are nonspecific and even though clinical examination can lead to correct diagnosis in case of varicose veins, it is important to promptly perform objective testing to confirm the diagnosis and enable the institution of safe and effective therapy.

Ambulatory venous pressure measurements were used as a hemodynamic complement to anatomic information obtained from venography phlebography which is

considered as the "gold standard" of venous imaging is expensive, time consuming, painful, exposes to radiation, lacks repeatability, requires expertise to perform and interpret reliably and associated with low but finite risk of contrast reaction and venographic phlebitis. This led to the development of several noninvasive techniques such as impedance plethysmography, air displacement plethysmography, iodine 125((1-125) fibrinogen scanning, and doppler ultrasonography.³

Impedance plethysmography is a physiologic test that measures changes in venous capacitance during physiologic maneuvers and detects abnormalities in the venous outflow. The predictive value of this test for detecting occlusive thrombi of approximately 90%. However it has low sensitivity for detection of calf thrombi, is highly operator-dependent and gives false negative results in the presence of non occluding thrombi, prominent collaterals or a duplication anomaly of the deep venous system. False positive results can occur in patients with CCF, venous insufficiency and extrinsic venous compression. radiation, lacks repeatability, requires expertise to perform and interpret reliably and associated with low but finite risk of contrast reaction and post venographic phlebitis. This led to the development of several noninvasive techniques such as impedance plethysmography, air displacement plethysmography, iodine 125((1-125) fibrinogen scanning, and doppler ultrasonography.⁴

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The introduction of doppler ultrasound technique has irrevocably altered the diagnosis and treatment of CVI. The rationale is quite simple: thrombotic obstruction of the underlying vein distorts the venous flow pattern and the doppler instrument readily in the clinic, at patient's bedside or even at home and the result is available immediately. it can be used in pregnant women, permits multiple views in various positions of the leg and the study is safe, painless, and inexpensive. Venous system is and augmentation. it is useful as a screening modality in high-risk patients to ensure prompt and early treatment duplex ultrasound, complemented with color flow imaging, has been validated as a sensitive modality for the identification of superficial and deep vein thrombosis. Valvular incompetence can be confirmed with superficial and color doppler, and unlike post plethysmography and APG, venous insufficiency can be localized to specific

value sites in the deep and superficial veins. Incompetent perforators can similarly be identified and mapped prior to intervention. The present study aims to evaluate the role of colour flow duplex ultrasound in clinically suspected patients of CVI of the lower limbs.

MATERIAL AND METHODS

It was prospective study done at Kamineni of medical sciences from 2012 to 2014. Total 50 cases are included in study with all clinically suspected cases of venous disease of the lower limb, referred to the department of radiodiagnosis were evaluated. All patients underwent detailed colour duplex ultrasound of the lower limb venous system. colour doppler studies were performed on ESAOTE 50 MY LAB VISION, SIEMENS ACUSON X300 and PHILIPS HD 15 ultrasound machines using high frequency (7-15MHZ) linear probes and low frequency (4-7 MHz)curvilinear probes wherever required.

Inclusion criteria: All patients clinically suspected to have chronic venous disease.

Patients who present with swelling and ulcers of the foot and leg.

Patients of both sexes and all age groups were included in the study.

Exclusion criteria: All patients with suspected arterial and lymphatic diseases of the lower limb were excluded.

Examination technique in lower limb doppler: Clear visualization of the lower extremity veins requires adequate distension of the venous system. Generally the venous system is examined in the supine position and the presence of incompetent perforators in the standing position with the patients putting his weight on the non examined limb. All venous segments were examined for the characteristics of venous flow and the effects of compression. The patients were instructed to breath normally during the USG examination.

STEP-1: Femoralsegment

STEP-2: Long Saphenous Vein:SFJ also examined in this step

STEP-3: Popliteal Segment

STEP-4: The Calf Veins: Anterior Tibial, Posterior Tibial And Peroneal Veins.

STEP-5: Iliac Veins all veins except the popliteal are examined with the patients in supine position. The popliteal veins are examined with the patient in the prone position and the knee slightly flexed. All veins are viewed in both transverse and longitudinal planes. The transverse plane is most useful to demonstrate the compressibility of the vein, and the longitudinal imaging for the flow pattern.

step-6: examination method for detecting incompetent veins: patient is examine in the standing position facing the examiner and supporting his or her weight on the

contralateral extremity

The following levels of perforators will be evaluated

1. Above knee (Dodds and Hunters)
2. Below knee medial upper 1/3 rd (Boyd s)
3. Below knee medial mid 1/3 rd (Cockett's)
4. Below knee medial lower 1/3 rd (Cockett's)
5. Upper posterior
6. Lower posterior
7. Lateral
8. Anterior

STATISTICAL ANALYSIS

Microsoft office 2007 was used for the analysis. Descriptive statistics like mean and percentages were used for the analysis.

RESULTS

Present study included 50 patients with clinical suspicion of chronic venous insufficiency in the lower limb, who had undergone duplex doppler study of the affected lower limb. A total of 20 patients were managed by surgery after proper assessment and exclusion of DVT.

The age group was wide varying from 19-80 yrs. most common age group was 41-50 yrs (12 cases) accounting for 24% of the cases with the mean age of 46.62. The male to female ratio was 4.5:1, with a male preponderance. The most common side of lower to be involved was left (23 cases, 46%) as compared to right (16 cases, 32%) or bilateral (11 cases, 22%) (table-1).

The most common pathology in patients with chronic venous insufficiency (43 cases) was varicose veins (36 cases, 83.7%) with the remaining 7 cases suffering from deep vein thrombosis (16.3%). Since many patients had involvement of varicosities the "n" was calculated as the no of lower limbs involved which came upto 46 cases. Most of the patients showed varicosities within the great saphenous vein (58.5%) (figure-1, table-2).

The most common site of reflex was perforator

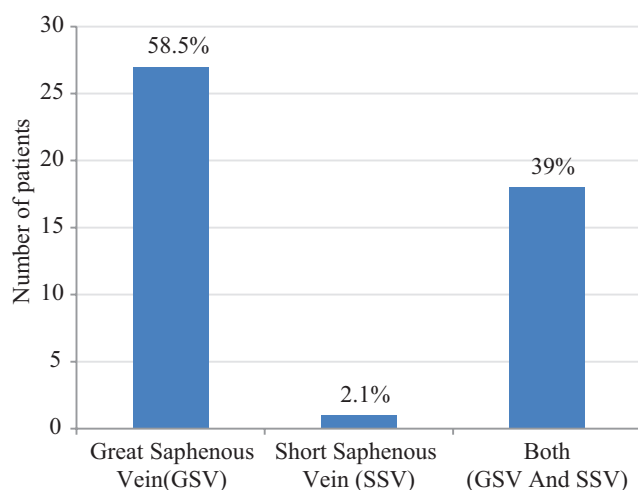


Figure-1: Distribution of study subjects according to the superficial venous system involved

(incompetence) with 27 cases (58.7%) followed by mixed incompetence (both junctional and perforator) (16 cases, 34.9%) sapheno-femoral incompetence (2.1%). Most of the patients had multiple level perforator incompetence, but the most common level was below knee medial mid 1/3rd (32 cases, 69.5%) and below knee medial lower 1, 3rd (31 cases, 67.4%). the least incompetent perforator was anterior (1 case, 2.1%). Among 43 patients suffering from CVI, 8 of had deep venous thrombosis with all of them having above knee thrombosis, and none of them having knee thrombus (table-4,5). Out of the 36 patients with

Age Group (Yrs)	No. of Study Subjects	Percentage(%)
11 to 20	1	2
21 to 30	11	22
31 to 40	6	12
41 to 50	12	24
51 to 60	10	20
61to 70	8	16
71to 80	2	4
Sex		
Male	41	82
Female	9	18
Total	50	100
Side		
Right	16	32
Left	23	46
Bilateral	11	22

Table-1: Demographic distribution of study subjects in present study

Doppler findings	No of study subjects	Percentage(%)
CVI	43	86
Bakers cyst	3	6
Cellulitis	4	8
Total	50	100
Pathology		
Varicose veins	36	83.7
DVT	7	16.3
Total	43	100

Table-2: Distribution of study subjects according to Doppler and pathology finding

Site	No of study subjects	Percentage
SPJ	2	4.3
SPI	1	2.1
Perforator	27	58.7
Combined (junctional and perforator)	16	34.9
Total	46	100

Table-3: Distribution of study subjects according to the site of reflex

varicose veins, 20 of them were operated and 19 (95%) of them showed correlation of doppler findings with the operative and the doppler findings of only 1 (5%) was not correlating with the operative findings.

DISCUSSION

In the present study 41 (82%) were male, and 9(18%) were female patients, which is in correlation with the study done by Aparna Irodi et al⁵ who reported that most of the patients in the study group were males (55 patients) as compared to females (22 patients) and study by Pramod Mirji et al⁶ with only 8 female (25%) and 24 (75%) male patients.

However, varicose veins are classically described to be common in women as proven by the Edinburg vein study (Evans et al) the lower incidence of chronic venous insufficiency in women in Indian population could be due to lesser no of Indian women seeking medical help

Level Of Perforator	No. of study subjects	Percentage (%)
Above Knee (Dodd's and Hunter's)	5	10.8
Below Knee Medial Upper 1/3rd (Oyd's)	21	45.6
Below Knee Medial Mid1/3rd (Cockett's)	32	69.5
Below Knee Medial Lower 1/3rd (Cockett's)	31	67.4
Posterior Leg Upper ½	15	32.6
Posterior Leg Lower ½	12	26.1
Lateral Leg	15	32.6
Anterior Leg	1	2.1

Table-4: Distribution of study subjects according to level of perforator incompetence

Segment involved	No of study subjects	Percentage
EVI	-	-
EVI+CFV	1	14.26
EIV+THIGH(CFV+SFV)	1	14.26
Thigh (CFV+SFV)	1	14.26
EVI+THIGH UPTO KNEE (CFV+SFV+PV)	2	28.57
Thigh upto knee (CFV+SFV+PV)	-	-

Table-5: Anatomical distribution of thrombi in study subjects with deep vein thrombosis (n=7)

Sex	Present Study		Irodi et al ⁵ (2011) (N=77)		Mirji et al ⁶ (2011)(N=32)	
	No	%	No	%	No	%
Male	41	82	55	71.4	24	75
Female	9	18	22	28.6	8	25
Total	50	100	77	100	32	100

Table-6: Sex wise distribution in present study in comparison to other studies

In the present study, patients aged from 11 to 80 years were included in the study. The most common age group was found to be 41-50 yrs, with the mean age being 46.82 years. as compared to 20-40 yrs. being the most common age group in the study done by Pramod mirji et al. which included patients aged from 20 yrs to 60 yrs.

In the Edinburgh vein study (Evans, 1999)⁷ the prevalence of trunk varicose from 11.5% in persons aged 18 to 24 yrs to 55.7% in the population between 55 to 64 yrs of age.

In the present study, there was a higher number of left sided limbs (23 patients, 46%), affected then the right (16 patients, 32%) or bilateral involvement (11 patients, 22%) in correlation with the study done by Aparna Irodi et al⁵ who reported the most common side of involvement as left (59 limbs) when compared to right (41 limbs), and also with the study study done by Pramod Mirji et al,⁶ with the most common side of involvement being left(15,46.75%) as compared to right (14,43.75%). This was attributed to the crossing over of left common iliac vein by right common iliac artery, giving rise to venous stasis.

Also in a venographic study of the incidence of DVT Stamatakakis JD et al⁸ found that major thrombi occur more frequently in the left limb

In the present study out of the 46 limbs with varicose veins, 27(58.7%) had varicosities of the GST, while only 1 (2.1%) patient had varicosities of both GST and SV. This is in correlation with the study done by Pramod mirji et al (2011) among the 32 patients examined 29 (90.63%) had varicosities of the GST while only 1(3.13) patients had varicosities and 2(6.25%) of them had varicosities of both GS and SSV.

Incompetent perforators were seen in most of the cases in the present study (43 limbs, 93.6%), isolated performance was noted in 27 in the present study DVT was seen in 7 of the cases. all the cases were acute, and showed thrombus within the deep veins of the proximal segment (above knee veins) with involvement of external iliac, femoral and popliteal segments in 2 patients (28.57%) being the most common. This roughly correlates with the study by Hill SL et al⁹ who found 49% thrombi in the thigh or popliteal region with calf involvement. the study reported involvement of iliofemoral segment in 16% CFV in 13% SFV in 19% PV in 18% calf veins 24% and superficial veins in 11% in the present study of 50 patients, 43 of them had CVI on doppler examination. Among which 7 of them were not fit for surgery due to the presence

Age (In years)	Present study (n=50)		Mirji et al 2011 ⁶ (n=32)	
	Number of patients	%	Number of patients	%
11-20	01	2	1	3.12
21-30	11	22	12	37.5
31-40	06	12	08	25
41-50	12	24	04	12.5
51-60	10	20	03	09.37
61-60	08	16	04	12.5
71-80	02	4	00	-

Table-7: Age wise distribution in present study in comparison other studies.

Limb	Present Study (N=50)		Irodi et.al, ⁵ 2011 (N=100 Limbs)		Mirji et al ⁶ (N=32)	
	No	%	No	%	No	%
Right	23	32	59	59	14	43.75
Left	11	46	41	41	15	46.87
Both	50	22	-	-	3	9.37
Total	No	100	100	100	32	100

Table-8: Distribution of study subjects according to the side of involvement in present study in comparison with other studies

of DVT in the remaining 36 patients with varicose veins, 20 of them were operated after venous mapping done by doper examination of the affected lower limb only 1 cases among the 20 patients showed recurrence in the immediate post- operative phase due to presence of the vein of giacomini {when the SPJ drains via the thigh extension (TE SSV) and posterior thigh circumflex vein (PTCV) into the GSV, the vein is called the vein of giacomini) which was not identified in the routine venous mapping before the surgery. Thus the sensitivity of index doppler examination and venous mapping prior to surgery was 95%, which is in correlation with the study done by Peter M dixon.¹⁰ Study reported a sentitivity of 98% in his study

CONCLUSION

The present study on 50 patients with clinical of CVI admitted in Kamineni institute of medical sciences, concluded that colour flow duplex sonography provides a good knowledge of the anatomy and the pathophysiology of CVI in each patient, describes the pattern of incompetence at the superficial and deep venous junction the distribution of the incompetent perforation and the prevalence og deep venous reflex, also helps in ruling out DVT (Contraindication to surgery).

Chronic venous insufficiency causes a great deal of morbidity in our population, however prevalence in indian population is not known. The finding of duplex sonography are important in planning the appropriate treatment, which includes surgical and non-surgical modalities.

Hence colour flow duplex sonography is an accurate investigation in demon striating the various spectrum of finding in a patients with CVI, and also has a high percentage correlation with operative finding, as in the present study.

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Source of Support: Nil; **Conflict of Interest:** None

Submitted: 25-08-2017; **Published online:** 25-09-2017