



PREOPERATIVE ASSESSMENT OF PRIMARY VARICOSE VEINS OF LOWER LIMBS BY DUPLEX COLOR DOPPLER ULTRASOUND: A VALIDATION STUDY

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ABSTRACT

INTRODUCTION: Varicose veins comprises a significant clinical problem representing underlying chronic venous insufficiency with ensuing venous hypertension leading to broad spectrum of clinical manifestations.

MATERIALS AND METHOD: Our study is based on evaluation of 125 limbs in 103 patients of lower extremity symptomatic varicose veins. After establishing the nature of venous incompetence and abnormality on both clinical and duplex ultrasonography, patients were subjected to surgery and sensitivity, specificity, positive and negative predictive values and diagnostic accuracy was calculated based on operative assessments and findings.

RESULTS: Non invasive diagnostic evaluation with duplex sonography in our study proved it to be suitable procedure when sensitivity, specificity and diagnostic accuracy was assessed.

CONCLUSION: We conclude that in comparison to the cumbersome clinical assessments alone, the combination of clinical with Doppler duplex ultrasounds, proved to be more suitable and reliable procedures in avoiding the inappropriate surgeries.

KEYWORDS : Varicose vein, Doppler Duplex ultrasound, Chronic venous insufficiency, Great saphenous vein, Short saphenous vein.

INTRODUCTION:

Lower limb varicose veins represent a significant clinical problem and not just a cosmetic issue. Doppler duplex ultrasound is widely used to investigate chronic venous disease of the lower limbs and has replaced many cumbersome physiological and clinical tests. Doppler ultrasound is an essential diagnostic tool that can accurately map the origin and extent of venous reflux. The obtained hemodynamic information would permit more selective multimodal therapy and avoid indiscriminate stripping of entire saphenous system in all cases of primary varicose veins¹. The incompetence at saphenopopliteal and saphenofemoral junction was mapped more accurately with duplex sonography when compared with other diagnostic methods². It has been seen that clinical techniques were much less sensitive and specific besides having uncertainty about incompetence in upto 52% of cases³. The use of color coded Doppler scanning has resulted in change of plan of operation in sizable number of cases, if it was left to clinical tests only. The escape points would have been left intact and many a times long saphenous vein would have been stripped unnecessarily⁴. Color Doppler imaging helps in individualizing the treatment to cases of "lower extremity primary venous insufficiency"⁵. Given the prevalence and socioeconomic impact of this disease, we validate the role of Doppler duplex ultrasonography in assessing and planning proper surgical modalities for lasting relief to our cases.

MATERIALS AND METHOD:

Our study was a prospective study conducted in the department of surgery, VCSG Govt. MS&RI, Srinagar-Garhwal Uttarakhand. The study was conducted after getting necessary approval from the ethics committee of the institution. The study was conducted between July 2018 to March 2020 on 125 limbs in 103 patients.

Inclusion Criteria-

All patients with lower limb varicose veins seeking treatment were subjects of our study.

Exclusion Criteria-

All patients with previous surgery for varicose vein (recurrent)

and those found to have secondary cause of the varicose veins.

METHOD-

The patients with varicose veins seeking treatment during the time period between July 2018 to March 2020 were assessed. All of the 125 limbs in 103 patients were first assessed clinically. The following particulars of patients were noted; age, sex, residence and occupation. The history was taken regarding the nature of their symptoms, history of previous treatment, drug intake, DVT and any other risk factors. This was followed by detailed clinical examination of patients for the presence of dilated veins, edema and skin changes like pigmentation/eczema, presence of active or healed and thus clinical severity grading was done.

To know the site of incompetence this was followed by some clinical tests like Brodie Trendelenberg's test, Tourniquet tests for saphenopopliteal junction, Cough test, Schwartz test, Multiple tourniquet test and Fegan test. After the clinical assessment the patients were subjected to Duplex Color Doppler Ultrasonography. The later examination in patients with CVD was used to demonstrate both anatomical patterns of veins and abnormalities of venous blood flow in the limbs. The nature of the venous incompetence as demonstrated by the color Doppler ultrasonography was taken as the standard.

The information obtained after performing various clinical tests was also used to predict specific valvular abnormality in the patient. Then different incompetent perforator sites were also marked on duplex ultrasound. After establishing nature of valvular abnormality in patient on both clinical and duplex ultrasound, they were taken for surgery. All incompetent sites detected on duplex or clinical or both examinations were operated. After obtaining information from all the patients, sensitivity, specificity, positive and negative predictive value and diagnostic accuracy were statistically calculated.

OBSERVATIONS AND RESULTS:

Out of 103 patients there were 68 males and 35 females with the difference by statistical significance at 95% confidence level. Most of our patients belonged to working age group, with mean age of 42.6 years. Duration of presentation of

symptoms ranged from 1 year to 20 years. Majority of our patients (83 patients) presented with duration of less than 5 years of their presenting symptoms. Bilateral limb involvement was seen in 22 patients and unilateral limb involvement was seen in 81 patients. Left limb was more commonly involved.

Signs observed in 125 limbs with varicose veins were dilated veins in all, edema, pigmentation, eczema, healed and active ulcers. Clinically 72 limbs belonged to C-2 severity according to CEAP system. C1, C5 and C6 were less commonly observed in less than 5% patients.

Clinical examination detected 96 SFJs and 37 SPJs in 125 limbs. It also marked 123 incompetent perforator sites in 49 limbs. [Table 1]

Table 1 - Results Of Clinical Tests.

Abnormality	No. of limbs
Saphenofemoral junction	96
Long saphenous vein	26
Saphenopopliteal junction	37
Perforators	49
No. of perforators marked	123 (sites)

Table 3- Comparison Of Clinical And Duplex USG Versus Operative Findings.

Incompetent site	Clinical evaluation		Duplex evaluation		No. of patients operated	Findings confirmed
	Results	No. of limbs	Result	No. of limbs		
Saphenofemoral junction	incompetent	96	incompetent	68	68	68
	competent	29	competent	28	28	0
Saphenopopliteal junction	incompetent	37	incompetent	9	9	9
	competent	88	competent	20	nil	nil
Number of perforator sites evaluated	incompetent	123	incompetent	13	13	13
	competent	53	competent	24	24	0
	incompetent	123	incompetent	21	21	21
	competent	53	competent	67	nil	nil
	incompetent	123	incompetent	63	63	57
	competent	53	competent	60	60	12
			incompetent	53	53	48
			competent	nil	nil	nil

On comparing sensitivity, specificity and diagnostic accuracy of duplex versus clinical examination, duplex was significantly better than clinical examination. On comparing the individual clinical tests with the duplex examination as

Anatomical sites of incompetence (according to duplex) in 103 patients showed most commonly involved long saphenous venous reflux in 92 limbs followed by SFJ in 77 limbs and perforators in 53 limbs. Deep veins were least involved in 5 limbs only. [Table 2]

Table 2- Anatomical Sites Of Incompetence (according To Duplex) In 103 Patients.

Site of incompetence	Number of limbs	%age
Long saphenous vein	92	73.6
Saphenofemoral junction	77	61.6
Short saphenous vein	23	18.4
Saphenopopliteal junction	34	27.4
Perforators	53	42.4
Deep veins	05	4

On comparing duplex versus clinical examination in diagnosing the sites of incompetence, all incompetent SFJs and SPJs marked by duplex examinations were confirmed as incompetent on exploration. Among perforators 57 of 63 marked by both examinations were incompetent, while as, 48 out of 53 sites marked on duplex were incompetent, but , out of 60 sites marked on clinical examination alone only 12 sites were confirmed. [Table 3]

standard, we found most tests had low sensitivity and specificity. Only trendelenburg test for SFJ had good sensitivity (89%) but was poorly specific and tap test for LSV had high specificity. [Table 4,5]

Table 4- Comparison Between Calculated Sensitivity, Specificity, Positive Predictive Values, Negative Predictive Value And Diagnostic Accuracy Of Clinical Tests and duplex USG With Operative Finding As Gold Standard.

Site	sensitivity		Value of x ²	Specificity		Value of x ²	Positive predictive values		Negative predictive values		Diagnostic accuracy		Value of x ²
	Clinical test	duplex		Clinical test	duplex		Clinical test	duplex	Clinical test	duplex	Clinical test	duplex	
SFJ	88.3	100	7.6	41.6	100	22.9	70.8	100	69	100	70.4	100	29.9
SPJ	38.2	100	14.3	73.6	100	25.7	35.1	100	76.1	100	64	100	44.3
Perforators marked	59.0	89.7	42.1	81.4	81.4	52.4	57.5	90.5	N.A	N.A	39.2	86.9	77.4

Table 5 - Comparison Of Individual Clinical Tests Compared With Duplex.

Test applied /site examined	Clinical evaluation		Duplex evaluation	
	Results	No. of limbs	Results	No. of limbs
Modified trendelenburg/ tourniquet test (SFJ)	Incompetent	96	Incompetent	68
	Competent	29	Competent	28
Cough test (SFJ)	Incompetent	58	Incompetent	9
	Competent	67	Competent	20
Tap test (long saphenous vein)	Incompetent	26	Incompetent	42
			Competent	16
			Incompetent	35
			Competent	32
			Incompetent	23
			Competent	3

	Competent	99	Incompetent	69
			Competent	30
Perforator incompetence	Incompetent	49	Incompetent	27
			Competent	22
	Competent	22	Incompetent	26
			Competent	50
Clinical tests for perforators (MMT, fegan's test)	Incompetent	123	Incompetent	69
			Competent	54
	Competent	53	Incompetent	48
			Competent	nil

DISCUSSION:

In our study when comparing the clinical findings and the color Doppler duplex ultrasound results we found 28 SFJs were unnecessarily explored and 9 SFJs would have been missed on clinical grounds alone. Similarly 24 SPJs were unnecessarily explored and 21 SPJs would have been left untreated on clinical basis alone. For perforators 59 sites were unnecessarily explored and 49 would have been left untreated on clinical grounds, while as on the basis of duplex 12 would have been missed and 11 sites explored unnecessarily. Our study demonstrated that on basis of clinical examination alone a large number of surgeries were done unnecessarily and many sites would have been missed bearing few perforated sites missed or wrongly explored on duplex USG basis. Our findings of high sensitivity and specificity for Duplex in detecting SFJs and SPJs incompetence are in accordance with the study done by Dixon PM⁶ and GWL Philips⁷.

So far as establishing a diagnosis of SFJ incompetence clinical examination was 88.4% sensitive and 41.6% specific when compared to 100 % specificity and sensitivity of duplex which is in accordance with the study done by Benabou JE et al⁸ and MG Vashisht⁹.

We have found clinical examination was 38.2% sensitive and 73.6% specific in detecting SPJs incompetence when checked intraoperatively as compared to 100% sensitivity and specificity of duplex. Similar results were observed in study of MG Vashisht⁹.

While evaluating the sensitivity and specificity of duplex and clinical examination for perforator incompetence the clinical examination had 59% sensitivity and 18.5% specificity in comparison to 89.7% sensitivity and 81.5% specificity for duplex. Similar results were obtained in results of Perik EJM¹⁰ and MG Vashisht⁹.

Individual clinical tests had low sensitivity and specificity in detecting incompetent sites which is in accordance with the studies done by WH Hoffman¹¹, J Kim¹² and Mc Irvine¹³.

The results of our study favour the role of duplex ultrasound in establishing the diagnosis, assessing the severity of reflux, incompetence and determining the anatomy while planning surgeries for symptomatic lower limb varicose veins avoiding unnecessary and wrong surgeries besides preventing the reoccurrence.

CONCLUSION:

Varicose veins is a common pathological entity affecting the lower limbs, most commonly in men in our society in working age groups presenting as a spectrum of disease from mildly symptomatic visible veins to disability related refractory venous ulcers. Clinical examination misses many incompetent SFJs, SSPJs and perforators, while as labelling a number of incompetent sites as competent. Hence clinical examination alone is not sufficient in guiding the treatment plan for varicose veins and so the Venous duplex imaging which combines B mode imaging of deep and superficial veins with pulsed Doppler assessment of flow is a well established method to plan management for symptomatic varicose veins

besides excluding acute venous problems like DVT, thus making it a gold standard and main stay non invasive evaluation of chronic venous insufficiency.

What the study adds to the existing knowledge? The description of lower limb venous anatomy demonstrated by ultrasound imaging is intended to be the basis for future research regarding the morphology of healthy and diseased, superficial and perforating veins.

Author's contribution:

Prof.(Dr.)Biant Singh: Conceptualized the study, Principal investigator, prepared the study protocol, participated in data collection, entry, preparation and editing of all drafts.

Dr. Manpreet Kour: Co -investigator, data collection, manuscript preparation.

Dr. Shwetabh Pradhan: Co- investigator, Review of literature and preparation of the drafts.

Funding: No funding sources

Conflict of interest: None declared

Ethical Approval: This study was approved by the Institutional Ethics Committee

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