"THE CLINICAL EFFECTIVENESS OF HAND-HELD DOPPLER ATTACHED TO A LAPTOP FOR ASSESSMENT OF VARICOSE VEINS"

PROJECT REPORT

DPU RESEARCH GRANT PROJECT

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INTRODUCTION

Varicose veins are defined as dilated, elongated, & tortuous subcutaneous veins> 3 mm in diameter measured in the upright position with demonstrable reflux.

Varicose veins is a common problem as seen in the clinical practice (prevalence 20-60%). It has a great socio-economic impact on the population at large, specifically so for those belonging to lower income group.

Venous reflux disease or venous reflux, which may also be referred to as chronic venous insufficiency, is a common condition. Chronic venous disorders (CVD) of the lower extremity are common problems caused by venous hypertension. Venous hypertension is usually the result of incompetent valves in one or more of saphenous veins & their primary tributaries. Venous reflux is usually the underlying cause of varicose veins, [1]

In this modern era also, the surgeons use all the standard clinical tests like Trendelenburg test, Multiple tourniquet test and Modified Perthe's test, but also they prefer to use hand held doppler during clinical examination of varicose veins. Thus, in the opinions of the examiners who support evidence-based recommendations easy accessibility HHD (Hand Held Doppler), has made old tests redundant. While using handheld Doppler the audio input need to be observed for the intensity and duration.

Thus, the examiners need to acquire the skill for hand held Doppler examination[3]. To confer more adaptability and objectiveness we are attaching hand held Doppler to laptop for visualising and recording the audio signals of the handheld Doppler.

According to us if we attach laptop to hand-held Doppler it will yield satisfactory results to consider to therapeutic decisions for the varicose vein patients and will help us to estimate the utility of hand held Doppler attached to a laptop against the gold standard duplex scanning examination of varicose veins.

AIM AND OBJECTIVES

AIM

To assess the clinical effectiveness of hand-held doppler attached to a laptop for assessment of varicose veins.

OBJECTIVES

To evaluate and compare the assessment of varicose veins by the following four modes.

A. Clinical judgement (various clinical tests)
B. Hand -held doppler (HHD)
C. Hand -held doppler (HHD) attached to a laptop
D. Duplex ultrasonography (Gold standard).

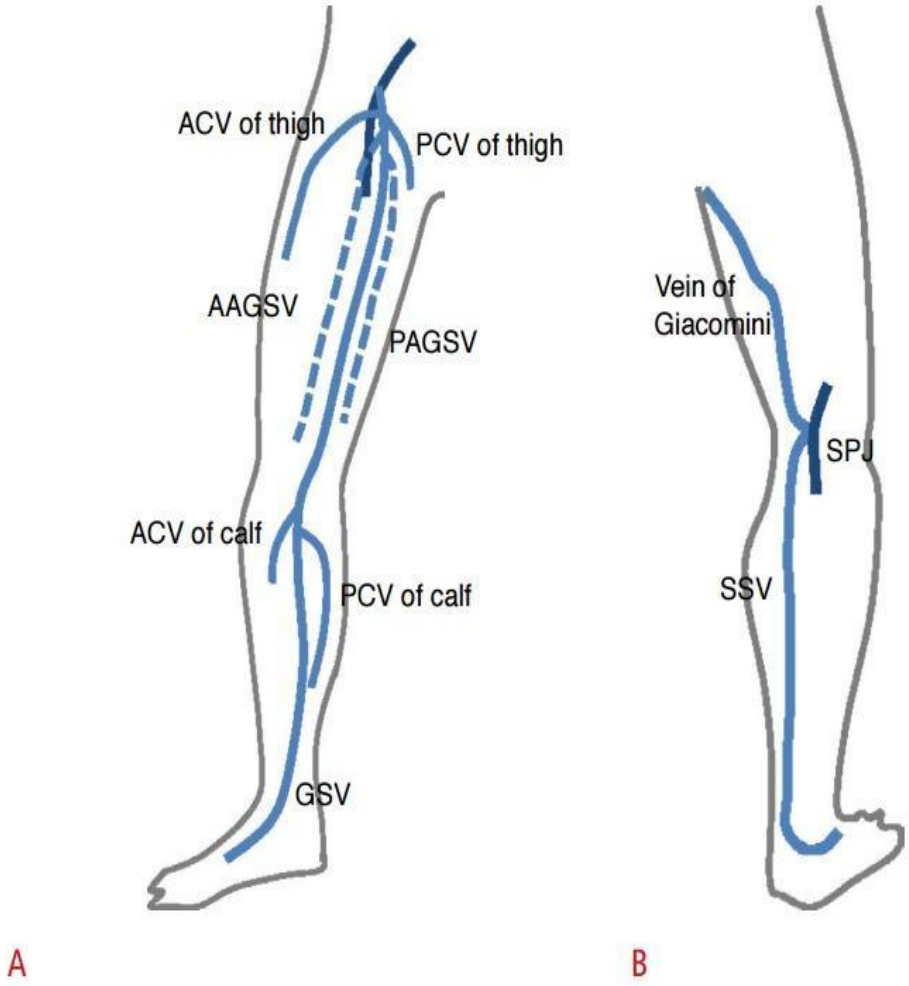
ANATOMY

1. Superficial Venous System

The two major superficial veins of the lower extremities are the great saphenous vein (GSV) and small saphenous vein (SSV). The terms “greater saphenous vein,” “long saphenous vein,” “lesser saphenous vein,” and “short saphenous vein” are no longer recommended for the purpose of standardising terminology.

The GSV begins in the medial marginal vein of the dorsum of the foot, ascends anteriorly to the medial malleolus, and passes posteromedially to the knee. The vein then ascends medially in the thigh to perforate the muscular fascia and join the common femoral vein at the saphenofemoral junction, 4 centimetres distal to the inguinal ligament. Tributaries of the GSV are variable between individuals, but there are general rules for naming them. If the course of the tributary is parallel to the GSV, it is called an accessory GSV (an anterior accessory GSV or a posterior accessory GSV). When the tributary courses obliquely, it is called the circumflex vein (the posterior thigh circumflex vein or the anterior calf circumflex vein).

The SSV arises from the dorsal pedal arch and ascends posterolaterally from behind the lateral malleolus. It ascends along the middle of the calf and ends in the popliteal vein in the poplitial fossa. However, there are many variations in the termination of the SSV, including without connection to the popliteal vein [5,14]. Before it penetrates the muscular fascia, it may branch out a cranial extension that goes upward to join the GSV through the posterior thigh circumflex vein (the vein of Giacomini



ACV- Anterior Cutaneous Vein

AAGSV- Anterior Accessory Great Saphenous Vein

PAGSV- Posterior Accessory Great Saphenous Vein

PCV- Posterior Cutaneous Vein

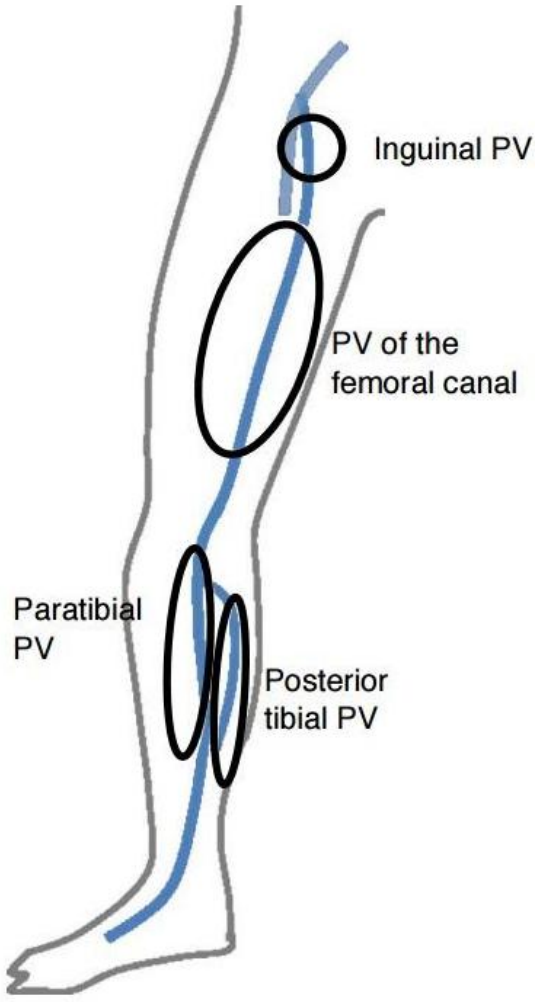
GSV- Great Saphenous Vein

SSV- Short Saphenous Vein

SPJ- Sapheno-Poplitial Junction

Perforator Veins

The perforating veins connect the deep veins with the superficial veins and direct the flow from the superficial to the deep system. There are numerous perforators in the leg. According to a consensus statement [10], perforators are named after their locations. Major groups classify perforators according to their longitudinal location as ankle, leg, knee, and thigh perforators. Subgroups indicate side (i.e., anterior, posterior, medial, and lateral perforators). Thus, the complete name of the perforator is a combination of the level and side (i.e., the medial leg perforator or the anterior thigh perforator). More detailed subgroups are present for medial thigh and medial leg perforators. The medial thigh perforators are further classified as the perforating vein of the femoral canal and inguinal perforating vein, and the medial leg perforators are subdivided into the paratibial and posterior tibial perforating veins. This is convenient because it eliminates eponyms such as Hunterian, Dodd, Boyd or Crockett, all of which have been used commonly.

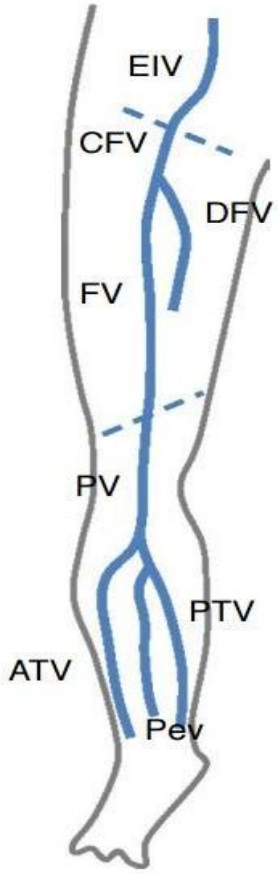


2. Deep Venous System

The major deep veins of the lower extremities follow the course of the corresponding arteries. The deep venous system of the calf includes the anterior tibial, posterior tibial, and peroneal veins. In the calf, these deep veins present as pairs on both sides of the artery. The posterior tibial vein receives blood from the medial and lateral plantar vein and drains the posterior compartment of the leg and plantar surface of the foot. This vein lies behind the tibia and joins the popliteal vein in the poplitial fossa. The anterior tibial vein is the upward continuation of the dorsal pedal vein. It runs along the anterior compartment of the leg just above the interosseous membrane between the tibia and the fibula, and joins the posterior tibial vein to form the tibioperoneal trunk and popliteal vein. The peroneal vein runs along the posteromedial aspect of the fibula and joins the posterior tibial vein.

The popliteal vein is formed by the junction of the anterior and posterior tibial veins at the lower aspect of the poplitial fossa. It ascends along the posterior aspect of the knee and the distal aspect of the anteromedial thigh. The popliteal vein is located medial to the artery in the lower knee, superficial to the artery at the posterior knee, and to the lateral side above the knee.

After the popliteal vein goes into the adductor hiatus, it is referred to as the femoral vein. The term superficial femoral vein is no longer recommended, because this vein is not a superficial vein, but rather a deep vein [9-11]. In the lower part, it lies lateral to the artery; in the mid-part, behind the artery; and in the upper part, medial to the artery. The deep femoral vein from the inner thigh, running along the deep femoral artery, joins the femoral vein and forms the common femoral vein, which is located medial to the common femoral artery. The inguinal ligament is the landmark that divides the common femoral vein from the external iliac vein.



EIV- External Ileac Vein

CFV- Common Femoral Vein

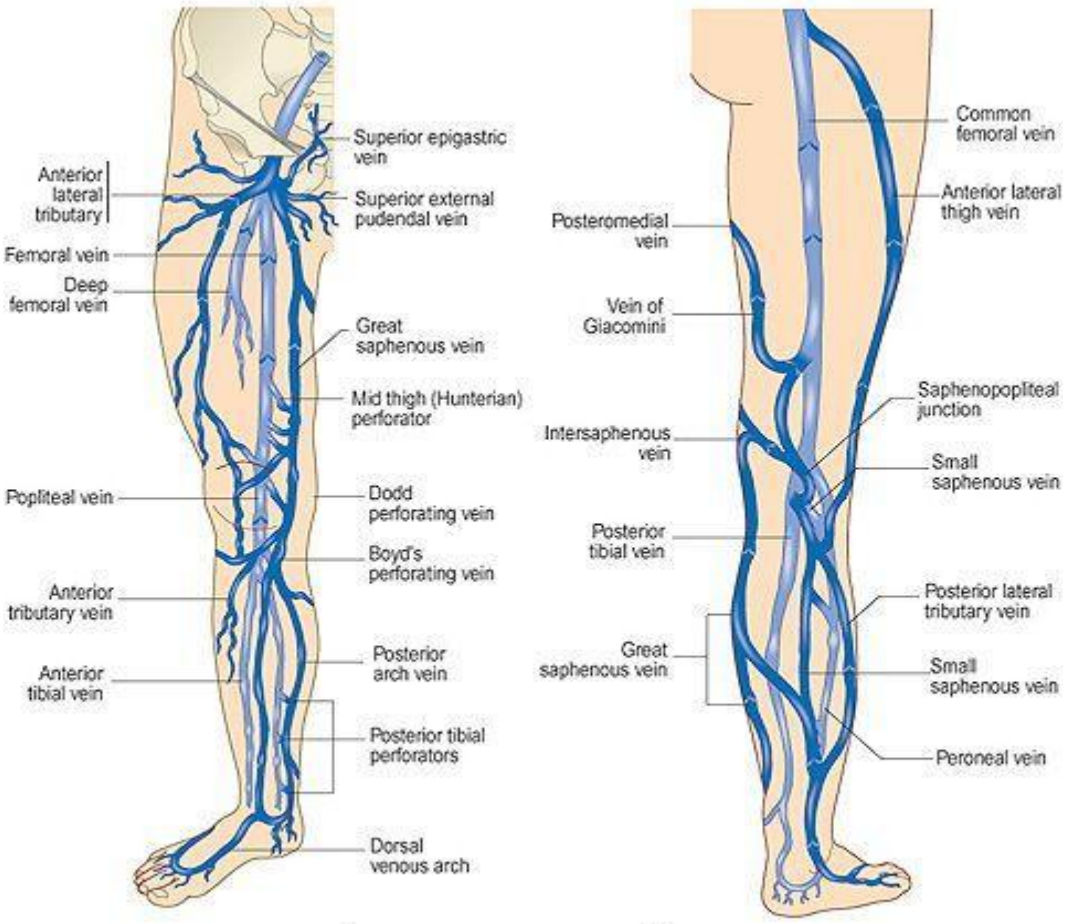
DFV- Deep Femoral Vein

FV- Femoral Vein

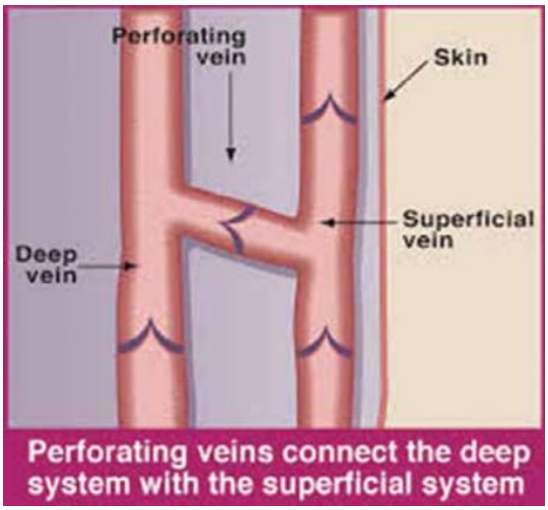
PV- Poplitial Vein

ATV- Anterior Tibial Vein

PTV- Posterior Tibial Vein



The Venous Anatomy of the Legs
Deep System - light blue Superficial System - dark blue



CEAP Classification System and Reporting Standard Revision 2020

C (Clinical Manifestations), **E** (Etiology), **A** (Anatomic Distribution), **P** (Pathophysiology)

C0	No visible or palpable signs of venous disease
C1	Telangiectasias or reticular veins
C2	Varicose veins
C2r	Recurrent varicose veins
C3	Edema
C4	Changes in skin and subcutaneous tissue secondary to chronic venous disease
C4a	Pigmentation or eczema
C4b	Lipodermatosclerosis or atrophie blanche
C4c	Corona phlebectatica
C5	Healed
C6	Active venous ulcer
C6r	Recurrent active venous ulcer

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Lurie et al. *J Vasc Surg Venous Lymphat Disord, May 2020*

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CLINICAL TESTS

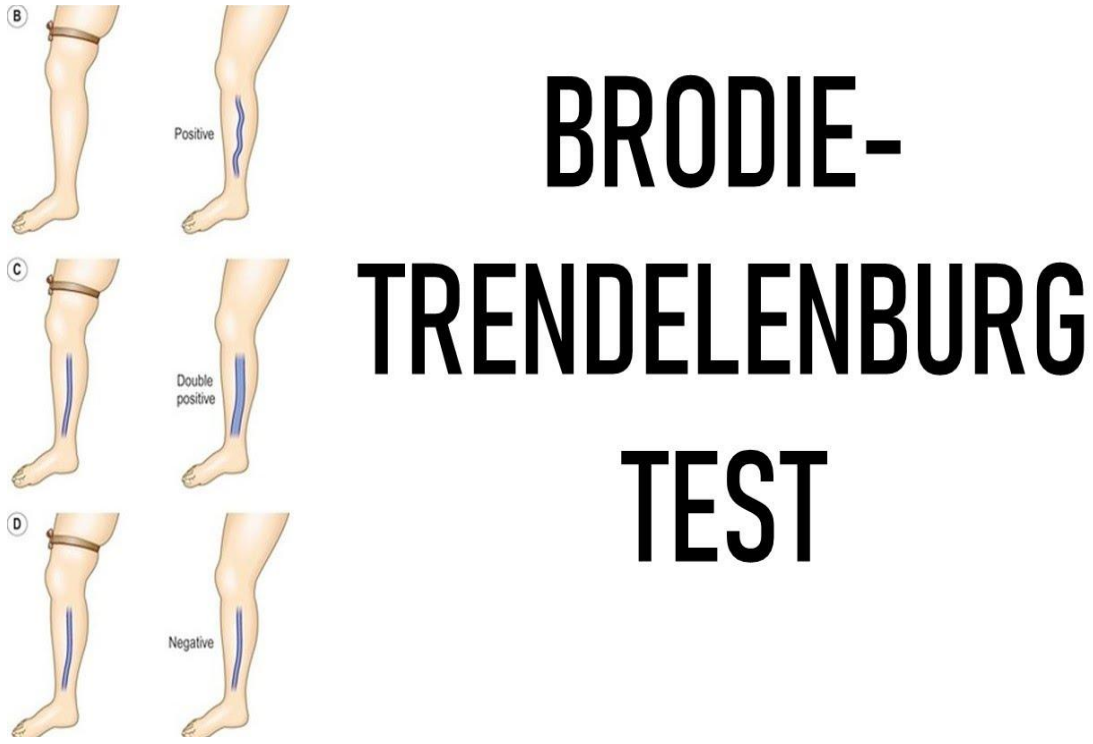
Brodie-Trendelenburg test:

The Trendelenburg test is used to assess the Sapheno -femoral junction incompetency. Competence of the sapheno -femoral junction (SFJ) will be assed by this test. While the patient in a supine position, the lower limb will be elevated to empty the superficial venous system.

Tourniquet will be applied just below SFJ which is 4cm below and lateral to pubic tubercle.Then patient will be asked to stand with tourniquet in position to observe the rapid filling of the varicosities due to incompetent perforators below the level of the SFJ.

Rapid filling of varicosities from above downwards after the release of the tourniquet denoting SFJ incompetence will also be recorded.

Filling of veins from below upwards without releasing the torniquet shows presence of distal incompetent perforators.



Multiple tourniquet test:

To find out the site of incompetent perforators, three torniquets are tied after emptying the vein.

At Sapheno-Femoral Junction.

A tourniquet is tied round the thigh or the leg at different levels after the superficial veins have been made empty by raising the leg in recumbent position.

The patient is now asked to stand up.

If the veins above the tourniquet fill up and those below it remain collapsed, it indicates presence of incompetent communicating vein above the tourniquet.

If the veins below the tourniquet fill rapidly whereas veins above the tourniquet remain empty, the incompetent communicating vein must be below the tourniquet.

Schwartz test

In a long-standing case if a tap is made on the long saphenous varicose vein in the lower part of the leg an impulse can be felt at the saphenous opening with the other hand.

Modified Perthes Test

In this test a tourniquet will be lightly applied just below the SFJ to compress superficially varicose veins but not the deep veins.

The patient will be asked to walk or perform toe stand movement and extreme pain along with increase in the engorgement and congestion of these will be observed.

Pratt's Test

This test is performed to know the positions of leg perforators.

Firstly, an Esmarch elastic bandage is applied from toes to the groin. A tourniquet is then applied at the groin.

This causes emptying of the varicose veins. The tourniquet is kept in position and the elastic bandage is taken off.

The same elastic bandage is now applied from the groin downwards. At the positions the perforators 'blow outs' or visible varices can be seen.

Morris's Cough Impulse Test

The limb is elevated to empty the varicose veins. The limb is then put to bed and the patient is asked to cough forcibly.

An expansile impulse is felt in the long saphenous vein particularly at the saphenous opening if the sapheno-femoral valve is incompetent. Similarly, a bruit may be heard on auscultation.

Fegan's Test

To indicate the sites of perforators.

On standing posture the places of excessive bulges within the varicosities are marked. The patient now lies down. The affected limb is elevated to empty the varicosed veins. The examiner palpates along the line of the marked varicosities carefully and finds out gaps or pits in the deep fascia which transmit the incompetent perforators.

Assessment of varicose veins by hand held Doppler alone

Doppler transducer will be positioned along the axis of a vein with a probe at an angle of 45 degree to the skin. Gentle tapping on the underlying vessel will produce a strong Doppler signal confirming the correct positioning of the transducer.

Compression of the vein below the level of probe will augment forward flow in the direction of valves. Release of this compression will cause backward flow through these incompetent valves giving rise to Doppler signal.

These compression – decompression manoeuvres will be repeated while gradually going up the limb. All the superficially visible or palpable veins will be investigated by hand held Doppler.

Ankle- brachial index (ABI) will be obtained for arterial insufficiency.

Doppler auscultation

The physical examination as described so far cannot differentiate dilated veins of normal function from true varicosities that carry venous blood in a retrograde direction. Doppler examination is an adjunct to the physical examination that can directly show whether flow in a suspect vein is antegrade, retrograde, or to-and-fro.

Doppler flow assessment adds a great deal of information to the physical examination findings, but patients with significant varicosities should also be evaluated by duplex ultrasonography, which combines Doppler flow detection with 2-dimensi

onal ultrasound imaging.

COMPLICATIONS OF VARICOSE VEINS

1. Superficial Thrombophlebitis
2. Deep Vein Thrombosis
3. Hemorrhage
4. Skin Pigmentation
5. Lipodermatosclerosis
6. Venous Ulcer
7. Periostitis

MATERIAL AND METHODS

The study was conducted in Dr DY Patil Medical College and Hospital Pune, India. It is prospective in design and was conducted amongst the symptomatic patients of varicose vein attending the outpatient department and among admitted patients in the hospital. The data was collected from 100 patients.

Study Design: A hospital based prospective study

Study Duration: 2 years

Study Area: The study was done at our tertiary care centre in the department of General Surgery, Dr. D. Y. Patil Medical College and Research Centre, Pimpri, Pune on attending OPD/IPD.

Study Population: All patients presenting with clinically significant dilated veins over lower limb attending OPD/IPD of a tertiary care hospital who fulfilled the inclusion criteria.

Sample Size: 100 patients

Sample size was calculated using the formula:

$n:[z^2p(1-p)]/d^2$

Where: Z= table value of alpha error from Standard Normal Distribution table (0.95)

Power (p) = 80%

Precision error of estimation (d) = 5.5%

n=[0.95x0.95x0.8(0.2)]/0.055x0.055=47.7

Hence a sample size of 100 patients was considered adequate for our study.

Inclusion Criteria:

1. Patients presented with clinically significant dilated tortuous veins with or without pain over lower limb.

Exclusion criteria:

1. Patients of varicose veins with complications.
2. Patient on steroid therapy.
3. Immunocompromised patients.
4. Patient already operated for various veins.
5. Uncooperative patients.

METHODOLOGY

The study was done at our tertiary care centre in the department of General Surgery, Dr. D. Y. Patil Medical College, Hospital and Research Centre, Pimpri, Pune on attending OPD/IPD after due permission from the Institutional Ethics Committee and Review Board and after taking Written Informed Consent from the patients.

After approval from the Institutional Ethics Committee a valid informed consent was taken. Once the patients were enrolled for the study, a thorough history and physical examination was done as per proforma. An informed consent was taken in written from patients or patients' attendant.

History

History of venous insufficiency (e.g., date of onset of visible abnormal veins, date of onset of any symptoms, any known prior venous diagnoses, any of pregnancy related varices)

Presence or absence of predisposing factors (e.g., heredity, trauma to legs, occupational, prolonged standing, sports participation)

History of oedema (e.g. Date of onset, predisposing factors, site, intensity, hardness, modification at night rest)

History of prior any evaluation for treatment of venous disease (medications, injections, compression stockings, surgery)

History of superficial or deep thrombophlebitis (e.g. date of onset, site, predisposing factors)

History of any other vascular disease (e.g. Peripheral arterial disease, coronary artery disease, lymphedema, lymphangitis), family history of vascular disease of any type.

CLINICAL EXAMINATION

Inspection

The course of all dilated veins that are identified will be marked along the leg with and later transcribed into medical records. Limbs will be inspected in an organized manner, usually progressing to distal to proximal and from front to back. The perineal region, pubic region and abdominal wall will also be inspected. Findings as ulceration, telengiectasias, atrophic blanching, interdigital mycosis, acrocyanosis, eczematous lesions, micro ulcers, stasis dermatitis, flat angiomata, scars from previous surgical operation or evidence of previous sclerosant injections will be recorded.

Deformities to be noticed and measurement with photographs will be taken for records.

Palpation

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Assessment of varicose veins by hand held doppler attached to a laptop

Hardware setup was done by connecting audio output to hand held Doppler with a USB port of the laptop.

The connection was done via a stereo audio to USB device such as griffin technology iMic .It is powered via a USG connector from the laptop. All the recordings got stored automatically .Recordings for the reflux will be taken by performing Valsalva manoeuvre. Tapping test was used to locate the venous junctions at the LSV. The recording was made with compression decompression manoeuvre over the long sapheno – popliteal junction & recorded.

The Doppler study of popliteal fossa will also be done in an upright position. Doppler study of popliteal fossa will also be done in an upright position with calf compression.

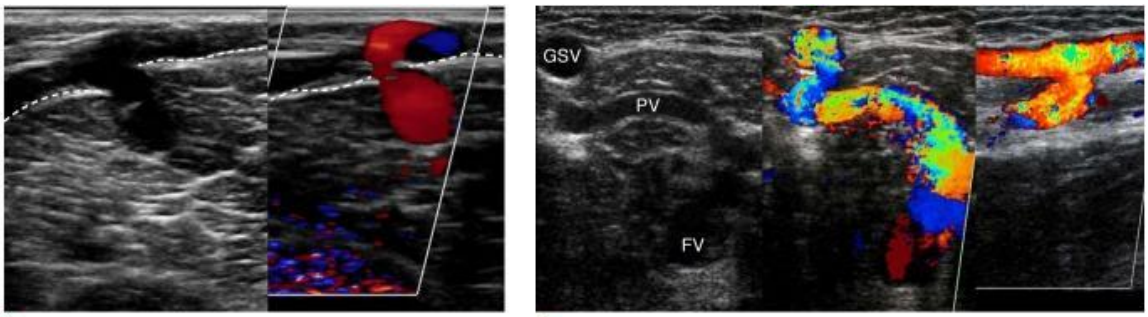
Assessment of varicose veins by duplex ultrasound scan

All the patients under this study were studied using duplex ultrasound scan from GE (pro series -400 model) by radiologist. The data and images taken from duplex scan will be saved. The result obtained from scan was considered as gold standard for reflecting the SENSTIVITY and SPECIFICITY of examination result obtained under three modalities.

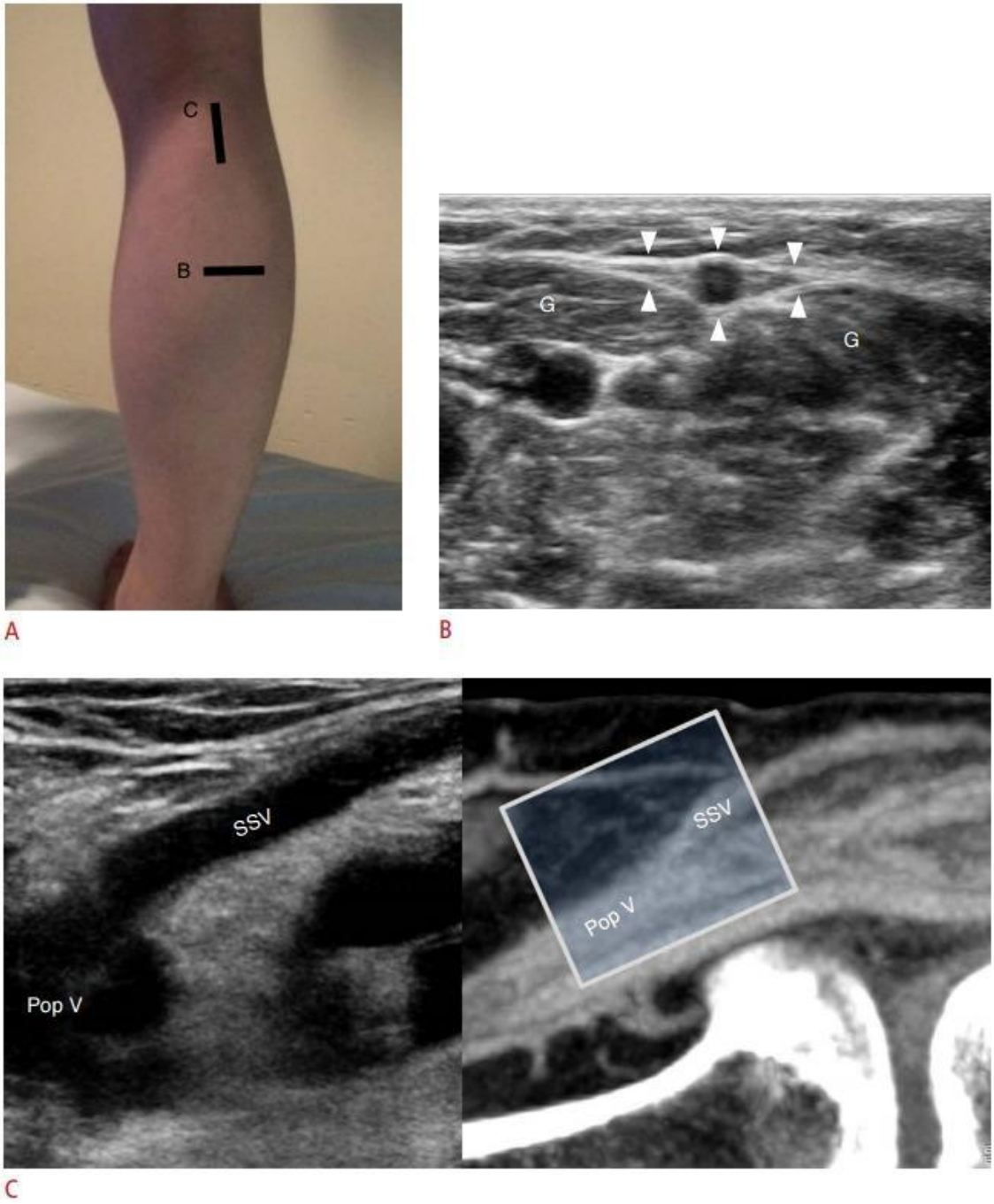
Clinical examination

Hand held Doppler examination

Hand held Doppler attached to a laptop



Ultrasonographic findings of perforating veins (PVs). A. A dilated paratibial perforating vein in the calf is shown here, which penetrates the muscular fascia (dotted lines). B. A dilated PV of the femoral canal is shown here, which connects the great saphenous vein (GSV) and the femoral vein (FV). Venous reflux from the deep to the superficial vein is seen on transverse and longitudinal views of Doppler ultrasonography.



Ultrasonographic findings of the small saphenous vein (SSV). A. Patient position and schematic representation of the transducer locations are shown here. B. In the transverse view of the posterior calf, the SSV is seen in the middle of the gastrocnemius (G) belly in the fascial trunk (arrowheads). C. Longitudinal ultrasound view and the corresponding sonic window in computed tomography venography based on transducer location are demonstrated. The SSV joins the popliteal vein (Pop V) through the saphenopopliteal junction. However, many variations are noted in this region, and the saphenopopliteal junction can be absent or hypoplastic.

Sample size calculation:

Sample size was calculated using the formula:

$n:[z^2p(1-p)]/d^2$

Where: Z= table value of alpha error from Standard Normal Distribution table (0.95)

Power (p) = 80%

Precision error of estimation (d) = 5.5%

n=[0.95x0.95x0.8(0.2)]/0.055x0.055=47.7

Hence a sample size of 100 patients was considered adequate for our study.

STATISTICAL ANALYSIS

The statistical package for the social science system version SPSS 20.0 will be used for statistical testing. Non-normally distributed data having continuous variables will be presented as mean ± SD or median (IQR). Categorical variable will be expressed as frequencies and percentages.

Student's t test will be used for the comparison of normally distributed continuous variables between the groups while the Mann Whitney U test will be used for the non-normal distribution data. A comparison between normal and categorical data between the groups will be done using Student t-test, Chi Square test or Fisher's exact test.

A p value of less than 0.05 will be considered statistically significant. Graphs were used to display the results where appropriate. Graphical representation will be done in MS Excel 2016.

OBSERVATIONS AND RESULTS

A hospital-based study was conducted in hundred patients to find out there effectiveness of hand held Doppler attached to a laptop for assessment of varicose veins.

Fig.1 Distribution of patients according to age

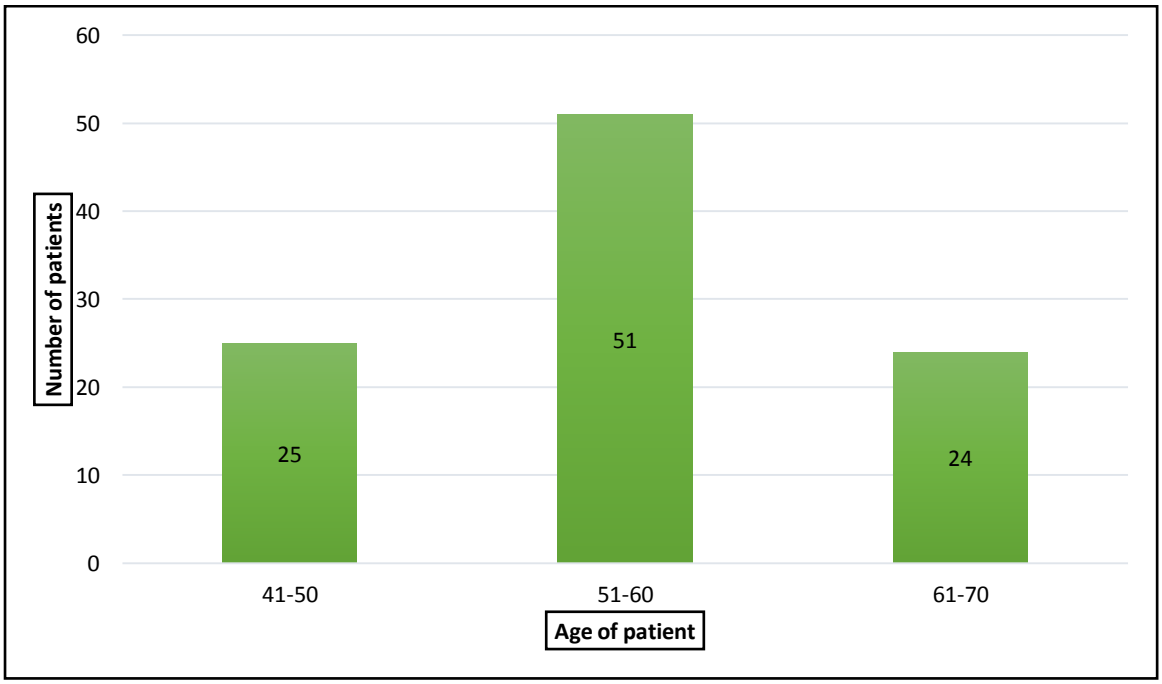


Fig .2 Distribution of patients according to gender

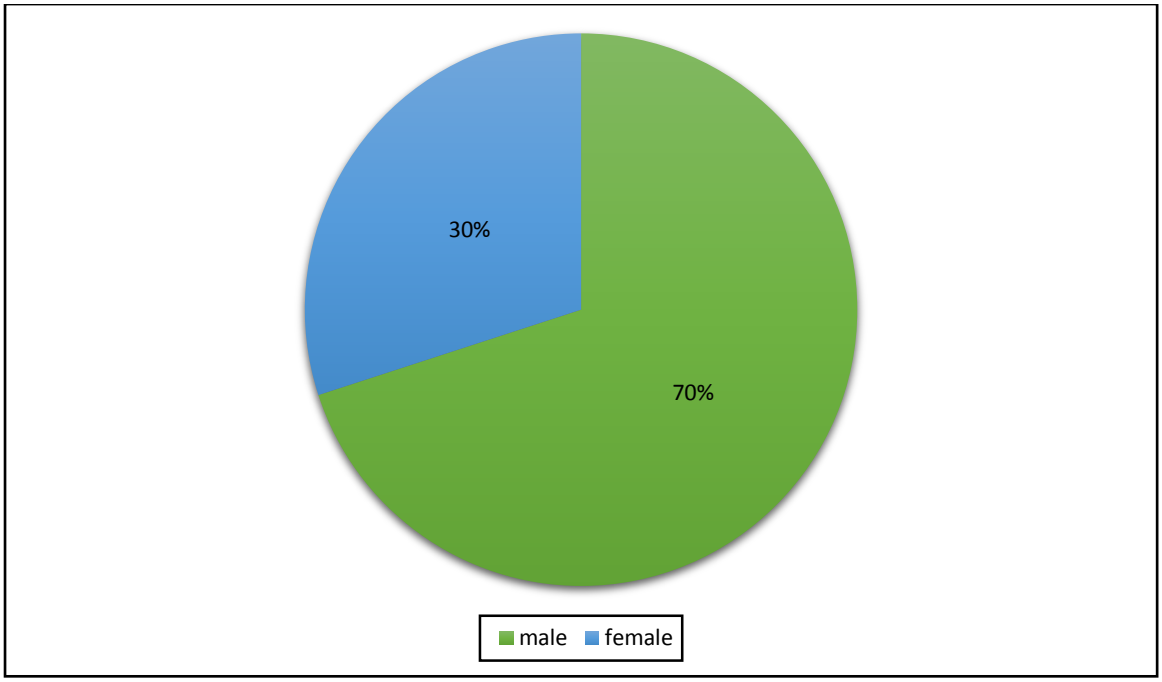
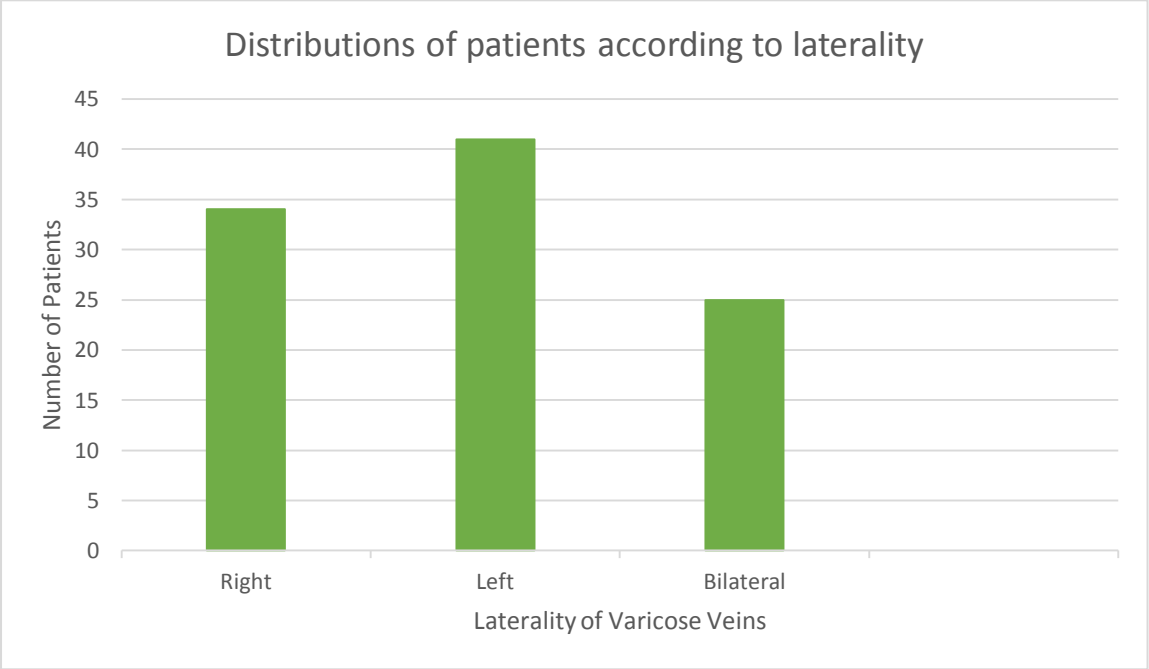


Fig.3 Distribution of patient according to laterality



Incompetent SaphaenoFemoral junction was detected by handheld Doppler and colour Doppler. In our study SaphaenoFemoral was incompetent in 81% by clinical test and 86% by handheld Doppler attached to a laptop. Whereas by colour Doppler 95% people were suffering from SFJ Incompetence.

In this study we have examined for 5 named perforators in the lower limb for all the patients by using multiple tourniquet test.

DVT was detected by modified Perthes test, hand held Doppler and colour Doppler.

Whereas modified Perthes test detected DVT in 4% cases, handheld Doppler detected in 6% cases and colour Doppler detected 8% cases.

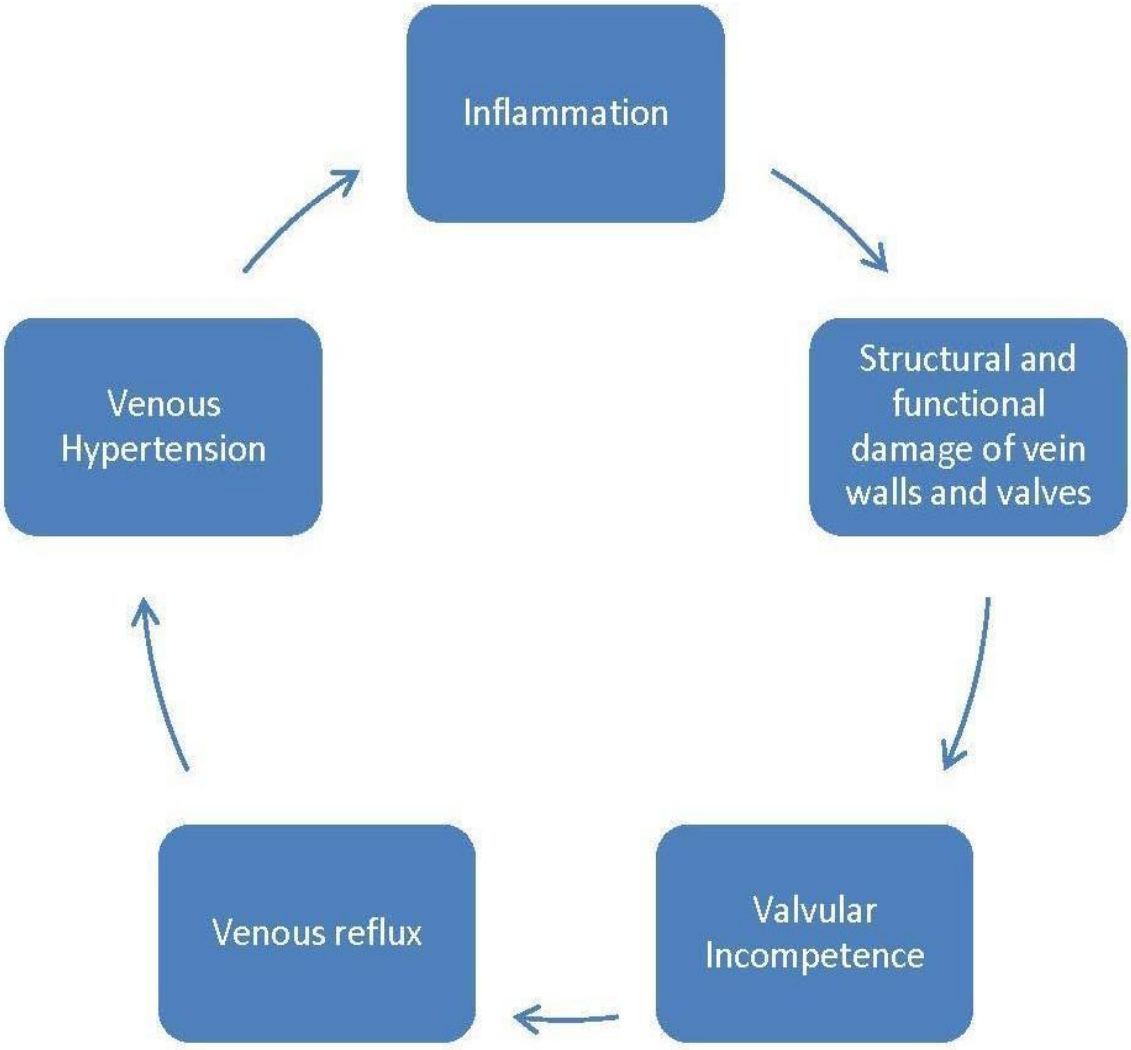
DISCUSSION

An awareness of the importance of the circulatory system can be traced back as early as prehistoric times; where cave paintings of bison and mammoth display an indication of the anatomical position of the heart[4-6]. Marcelo Malpighi established the basic structure of the circulatory system known today.

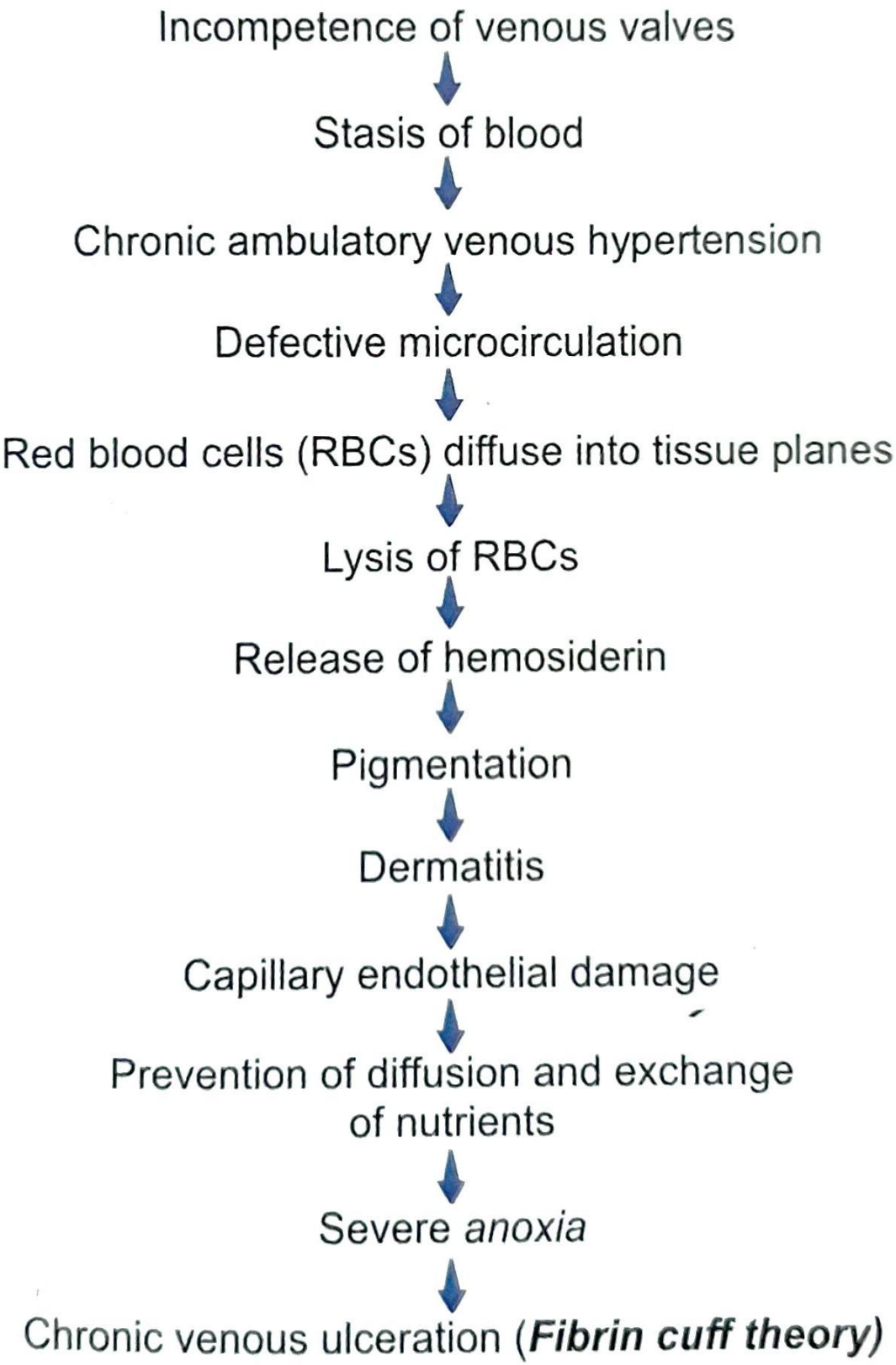
The early writing on the circulation, present in the Ebers Papyrus (written around 1550BC; thought to be a transcription of a documents from around 3400BC), were developed over time by researchers such as Hippocrates and Galen[7-9]. The first documented attempts at the treatment of varicose veins also were done by Ebers papyrus

Veins are the blood vessels that return blood to the heart from the body. The leg veins must overcome gravity to perform their job, and are aided by the muscles of the calf, which squeeze the veins, pushing blood toward the heart. A series of valves, or one-way flaps of tissue, prevent blood from flowing backward. In some people, stretching of the veins near the surface of the skin (superficial veins) and failure of the valves to close properly allows blood to flow in both directions. This backward flow of blood is called venous reflux.

The superficial venous system comprises of the great saphenous and short saphenous venous systems, with intercommunicating veins, which have a complex and highly variable anatomy. Superficial systems drain into the deep venous system comprising of the anterior tibial, posterior tibial, peroneal, popliteal and femoral veins. This communication between the superficial and deep venous system is achieved through perforators[10]. Effective venous drainage is maintained because of the unidirectional flow of blood, by means of valves. Any pathology causing these valves to not function properly may lead to formation of varicose veins.



The Vicious Cycle of the pathophysiology of primary venous insufficiency



Pathogenesis of Varicose Vein and Venous Ulcer

Risk factors

Age: There is strong evidence that the prevalence and severity of venous disease increases with age.

Gender: Most studies find this to be higher in women, but the Edinburgh vein study showed the opposite. What does seem clear is that a greater proportion of men suffer with CVI and male gender may be a risk factor for progression from varicose veins to CVI.

Pregnancy: Pregnancy is a proposed explanation for the increased incidence of varicose veins in women, with multiparity being associated with a greater prevalence than nulliparity. There is even evidence of a "dose response" with incidence increasing with the number of full term pregnancies. This is not a unanimous view however and some of these studies may be biased by a failure to control forage[12].

The most obvious is that the increase in intra-abdominal pressure associated with the enlarging uterus impedes venous return[13] .Relaxin causes softening of connective tissues. The primary function of this is in preparing the pelvic structures for delivery, but it also, works alongside oestrogen to mediate vasodilatation; which in turn results in increased venous stasis and valvular dysfunction[14-15].

Heredity: Two large population based risk factor studies found that a family history of a first degree relative with venous insufficiency was the most powerful risk factor for developing the disease, increasing the risk by approximately 3.5 to 5 times[16]. There are known congenital syndromes associated with venous disease, but to date no genotypes have been convincingly associated with the heritability of primary venous insufficiency.

Body Mass Index: Evidence on the significance of body mass index is mixed and much of it is very weak. Amongst the most convincing evidence is seen in the Bonn vein study[17], which found an increase in the prevalence of SVI associated with a greater BMI.

Lifestyle: Standing predisposes to venous insufficiency. Constipation has been suggested as a potential cause, with a loaded colon compressing the pelvic veins and the effect of straining at stool on intra abdominal pressure as suggested mechanism. The evidence to support any association between varicosities and other lifestyle factors such as social

class, education, tight undergarments, toilet posture, chair sitting, oral contraceptives, hormone replacement therapy and smoking is also lacking.

The cause of varicose veins may vary. Prolonged standing leading to raised intra venous pressure, raised intra-abdominal pressure due to tumours, pregnancy, obesity, and chronic constipation; familial and congenital forms of the disease, secondary vascularization due to deep venous thrombosis and, arteriovenous shunting have been some of the etiologies.

Strong forces and inflammation have recently been identified as important causative factors for venous disease[16-20]. Venous disease causing valvular reflux is observed to be the basic pathogenesis for the development of varicose veins. Rather than blood flowing from distal to proximal and superficial to deep, failed or incompetence of the valves is responsible for the blood to flow in the opposite direction. With the raised pressures over the local venous system, the larger affected veins may become enlarged and tortuous. Although no specific cause is found, in most cases the valvular dysfunction is presumed to be caused by a loss of elasticity in the venous wall, with failure of the valve leaflets to approximate each other. The clinical picture of varicose veins varies among patients and some patients are asymptomatic.

Doppler ultrasound

It was used for detecting deep vein occlusion. The use of Doppler ultrasound for direction flow was started in early 70s.The utility of continuous wave (CW) Doppler was far superior to clinical assessment alone in identifying the sites of deep to superficial assessment of the patients with venous disease [3,21]. The Hand Held Doppler HHD it is inexpensive and simple tool .It is easy to use in the outpatient department to check the venous system.

The HHD which consist of piezoelectric crystal probe emitting a continuous beam of ultrasound waves which detect erythrocytes moving in the targeted vein by Doppler shift principle. When the ultrasound beam strikes the moving object, the frequency of the beam changes in the proportion of velocity of the object and the angle of strike. In the HHD this quantitative shift is converted into an amplified audible sound. Several Doppler probe frequencies such as 4.5 and 8 MHz are commercially available for clinical

use. For the Doppler penetration it is necessary to use the Doppler probe with lower frequency.

While using HHD probe a coupling gel is applied to the skin for better transmission of ultrasound between the probe and tissue. To receive the audible sound from vein the doppler probe is directed towards the vein based upon anatomic landmarks while enhancing the venous flow by tapping or squeezing the limb . The reflux can be elicited by the release of calf compression with the patient in a standing position. Increasing the intra-abdominal and intrathoracic pressure with the Valsalva manoeuvre can create reverse flow in an incompetent vein or venous junction[22]. The significant reflux is defined by the audible flow signal lasting longer than one second.

When duplex ultrasonography arrived in laboratory, HHD was found inadequate for locating the vein , direction of flow and subjective interpretation of audible sound. The anatomical variability can also create problems while using HHD. It is also difficult in assessing the reflux in popliteal fossa by HHD.

Duplex ultrasonography

At present colour flow duplex scanning is the gold standard for non-invasive anatomical and functional assessment of venous reflux. This has also helped us to understand pathophysiology of venous disease and continuously influencing the management of varicose veins[23]. Duplex scanning combines flow imaging and the anatomical details. By Duplex ultrasound we can visualize the vessels, while examination with the duplex ultrasonography the reflux is elicited by the Valsalva manoeuvre or compression of proximal or distal limb by either manual or pneumatic stimuli. Examination need to be conducted in various positions, such as supine or standing erect. It is time consuming and more expensive and requires a radiologist[24].

CONCLUSION

Clinical examination & various tests are the basis of varicose veins assessment. Hand Held Doppler is inexpensive & simple method of assessment.

It is easy to use on OPD basis to assess venous system, especially for screening of large population in the peripheral hospitals.

To confer more adaptability & objectiveness of the test, further more served by attaching HHD to the laptop for visualising & recording the audio signals of the Hand Held Doppler.

It yields a satisfactory result to consider the therapeutic decisions for varicose vein patients. It helps in data storage as well, while displayed on the large screen.

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