



ORIGINAL RESEARCH PAPER

Radiodiagnosis

THE EFFICACY OF DUPLEX SONOGRAPHY IN DETERMINING PROGNOSIS OF VENOUS THROMBOSIS OF LOWER LIMBS

KEY WORDS: Colour Doppler, DVT

Dr. Shrishti Singh Thakur*

Resident, MGM Medical College and Hospital Kamothe, Navi Mumbai, 401209
*Corresponding Author

Dr. Ashutosh Chitnis

Professor, MGM Medical College and Hospital, Kamothe, Navimumbai

ABSTRACT

INTRODUCTION: Chronic venous insufficiency of the lower limbs is characterized by symptoms and signs produced by venous hypertension as a result of structural and functional abnormalities of veins that may eventually give rise to lower extremity, edema, pigmentation pain and ulceration.

OBJECTIVES: This study was done to detect and describe doppler ultrasound appearance in DVT and venous insufficiency.

METHODS: Study of 50 patients presenting with symptoms lower limb venous insufficiency to the department Radio-diagnosis, MGM Hospital, Kamothe, Navi Mumbai was done using duplex sonography during July 2015 to July 2017.

RESULTS: In the present study of 50 patients with suspected venous pathology, colour duplex sonography could identify the cause of symptoms in 42 patients. It was of immense importance and utility.

CONCLUSION: Colour duplex assessment of peripheral veins gives diagnostically adequate anatomic and hemodynamic information. Doppler ultrasound provides a noninvasive and reliable method for examining the venous system, particularly with respect to the diagnosis of thrombus in symptomatic patients.

INTRODUCTION

Chronic venous insufficiency is venous valvular incompetence in the superficial, deep and/or perforating veins. They prevent reversal of blood flow and venous hypertension in distal segments. Their incompetence leads venous congestion in veins leading to thrombosis.. Chronic venous insufficiency of the lower limbs (CVI) is characterized by pain, 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.² Because the history and clinical examination will not always indicate the nature and extent of the underlying abnormality (anatomic extent, pathology, and cause), a number of diagnostic investigations have been developed that can elucidate whether here is calf muscle pump dysfunction and can determine the anatomic extent and functional severity of obstruction or reflux.¹ Chronic venous insufficiency may affect only the superficial veins or it may be a sequelae to deep vein thrombosis. 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 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. Varicose veins have a wide clinical presentation ,which if recognized early can significantly reduce the morbidity of patients. However since 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 therapy³. Phlebography which is considered as the "gold standard" of venous imaging is expensive, invasive, 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 post venographic phlebitis. This led to the development of several noninvasive techniques such as impedance plethysmography, air displacement plethysmography, thermography phlebography, iodine 125(1-125) fibrinogen scanning and doppler ultrasonography. 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 proximal veins is approximately 90%.⁴ 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 these perturbations are readily detected by the Doppler instrument.⁵ Venous system is evaluated for flow, phasicity, pliability and augmentation. It is useful as a screening modality in high-risk patients to ensure prompt and early treatment. Duplex ultrasound, complemented with colour flow imaging, has been validated as a sensitive and specific modality for the identification of superficial and deep vein thrombosis.^{6,8}

AIM AND OBJECTIVES

1. To detect and describe doppler ultrasound appearance in DVT and venous insufficiency and to prove it to be foremost imaging technique to be used for the same.
2. To differentiate between obstruction and valvular incompetence.
3. To distinguish between acute and chronic thrombus.
4. Evaluation of extent of thrombus.
5. Use of colour doppler to identify and mark the site of perforators.

MATERIALS AND METHODS

Source of data: The present study included patients who were referred to the Department of Radiodiagnosis with complaints of with symptoms of lower extremity chronic venous insufficiency.

Method of collection of data:

- a) **Study design:** prospective study
- b) **Study Place:** Department of Radio diagnosis, MGM hospital, Kamothe, Navi Mumbai
- c) **Study duration:** July 2015 to July 2017
- d) **Sample Size:** 50
- e) **Inclusion criteria:**

- Clinically suspected cases of chronic venous disease.
- Patients who present with swelling and ulcers over the foot.

f) Exclusion Criteria:

- Pregnant ladies
- Seriously ill patients

g) Methodology:

Standard examination evaluated common femoral vein, superficial

femoral vein, popliteal vein followed by calf veins. The patient was examined in supine position with legs abducted and extremely rotated with slight flexion of knee for evaluation of femoral venous segment. Patient was given prone position for evaluation of popliteal vein. Calf veins were evaluated in supine position and the knee slightly flexed, internally rotated for the anterior tibial veins and externally rotated for the posterior tibial and peroneal veins.

7.5 MHz linear array transducer was used for femoral and popliteal venous segments and calf veins. Superficial venous system was assessed for SFJ and SPJ incompetence. For detection of incompetent veins, patients were examined in standing position facing the examiner supporting his/her weight on contralateral extremity. Veins were manually compressed (asked to cough, perform valsalva maneuver) and released suddenly and tested for reflux. In lower extremity venous imaging; in which vessels run parallel to the skin surface without tortuosity, all venous segments were encoded in blue and corresponding arteries in red.

Examination included gray- scale, colour Doppler and spectral evaluation of lower extremity veins. Statistical analysis by proportions.

OBSERVATIONS AND RESULTS

Males contributed the major group 38 (76 %) in our study with suspected venous abnormalities and they also had a higher incidence (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 chronic venous insufficiency. In our study venous abnormalities were more common in left extremity. 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 Deep vein thrombosis the most common symptom was swelling (55.56%), next most common symptom was venous ulcer (38.89%). In the present study thrombosis was localized to thigh or popliteal region in 15 (83.33%) of the total 18 cases of Deep Vein Thrombosis. The distribution of thrombi in the present study are as follows- 5.56% in common iliac vein, 22.22% in external iliac vein, 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. Loss of compressibility was a criteria for diagnosis of DVT. Compressibility of veins were lost in all 18 case of DVT. Presence of signal void even on augmentation was also a criteria for DVT, was found in 13 cases with complete thrombosis. Eccentric flow was demonstrated in 5 patients with partial thrombosis. The colour Doppler flow imaging diagnosis based primarily on the presence of a focal void within the colour encoded blood flow or the absence of visible flow within a segment of a vessel. In our study 8 patients presented with venous ulcer (severe degree of CVI); of these 7 (87.5%) patients showed DVT (with superficial and deep venous reflux, mainly perforator incompetence) on doppler examination. Varicosities along great saphenous vein predominated in our study, 30 cases (75%); and along short saphenous vein 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. Perforator incompetence was seen in 31 (77.5%) cases of the 40 varicosity cases. Below knee, mid calf and above ankle perforators showed (20 cases each, 50%) equal incidence and distribution and were the most common. Out of the 8 cases with normal doppler study, 2 cases showed clinical conditions mimicking DVT with pain and swelling; they were bakers cyst and cellulitis.

ILLUSTRATIVE CASES

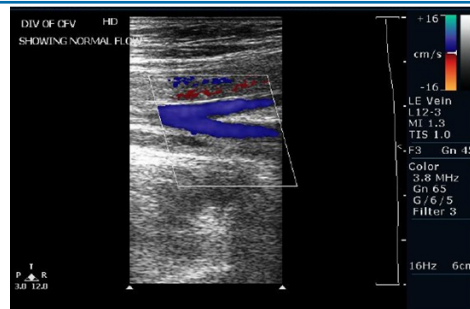


Fig. 8 : Longitudinal image showing normal anatomical confluence of superficial and deep femoral vein uniting to form common femoral vein with normal colour flow noted in all the veins

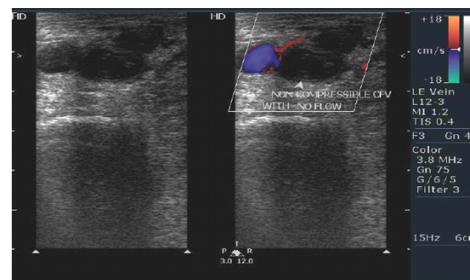


Fig. 15 : Transverse image of the common femoral vein thrombosis : showing lack of compressibility of common femoral vein with increased venous diameter and absence of spontaneous colour flow suggestive of thrombosis

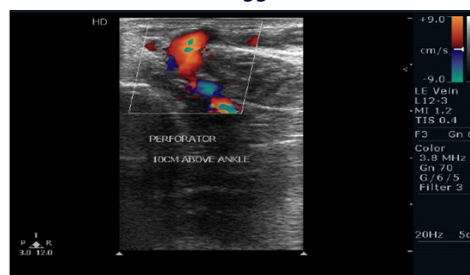


Fig 17 : Transverse image of mid calf incompetent perforator showing flow from deep to superficial on distal compression

DISCUSSION

In a randomized controlled study Belcaro G et al (2002) Italy, found that venous abnormalities increased with increasing age. In the Edinburgh Vein Study (Evans, 1999), the prevalence of trunk varices rose from 11.5 % in persons aged 18 to 24 years to 55.7 % in the population between 55.64 years of age. The occurrence of skin changes in CVI depend on the patient's age as well⁹. The incidence of DVT increases exponentially with age for both idiopathic and secondary DVT rising nearly 90-fold between 15 and 80 years of age with a relative risk of 1.9 for each 10-year increase in age.¹⁰ In the study by Glover G et al (1996) 40% of cases with unilateral leg swelling were found to have deep venous thrombosis by duplex scanning, whereas DVT was evident in only 5% of patients in the absence of leg swelling. This is explained by the venous physiology that when the major venous channels are occluded, the resultant increase in venous pressure and volume manifest itself as edema. The study by Hill SL et al (1997) reported involvement of iliofemoral segment in 16%, common femoral vein in 13%, superficial femoral vein in 19%, perforator vein in 18%, calf veins in 24% and superficial veins in 11%. In this studies, the incidence of post thrombotic syndrome was 35 to 69%, 3 years after deep venous thrombosis; and 49 to 100%, 5 to 10 years after, depending on the extent of thrombosis. The incidence of post thrombotic syndrome and the severity of hemodynamic abnormalities increased when the popliteal or proximal veins were involved in the

original thrombotic episode.¹² Benedict PJ et al (1995) found that approximately 20% of patients with superficial phlebitis also have associated occult deep venous thrombosis; and that approximately one third of these who have only superficial phlebitis initially will eventually extend the thrombus to deep system via sapheno femoral junction or perforating veins¹³. In a study by Hussain RA et al (1995) who studied 65 patients with venous ulcers and found that 56 (i.e. 86%) showed deep venous thrombosis. Thus venous ulcers were more common in the presence of underlying deep venous thrombosis, and deep venous thrombosis should always be excluded in these patients. Another study by Lees et al 1993, and Labropoulos et al 1994 related development of ulcer to presence of reflux of blood from the deep system to the superficial system through incompetent perforators. Post-thrombotic syndrome may result from some obstructions that remain in the vein or from reflux (backflow of blood) or both (more likely). In a study by Engelhorn CA (2005) et al¹⁴, he concluded that reflux was presenting 472 extremities (80%): 100 (17%) had reflux in both the great saphenous vein and short saphenous vein, 353 (60%) had Great saphenous vein reflux only, and 19 (3%) had short saphenous vein reflux only, for a total prevalence of 77% at the great saphenous vein and 20% at the short saphenous vein. In a study by Dellis KT et al (1998) who found that incompetent perforator vein are located predominantly in the medial aspect of lower extremity, more often in the middle third of the calf, followed by lower calf and middle thigh. The prevalence of perforator vein and their calf to thigh ratio increased linearly with the clinical severity of chronic venous insufficiency.

CONCLUSION

In the present study of 50 patients with suspected venous pathology, colour duplex sonography could identify the cause of symptoms in 42 patients. It was of immense importance and utility with respect to the following: To differentiate between obstruction and valvular incompetence, Accurate clot localization in cases with diagnosis of deep vein thrombosis, Evaluation of the extent of thrombosis, To define the location and extent of valvular dysfunction, Easily evaluate the competence of sapheno femoral junction and saphenous popliteal valves, To distinguish whether saphenous vein is involved and whether the involvement is confined to the venous tributaries or perforators, Depicting anatomic variations, collaterals, Excluding other causes of pain and swelling of lower limbs., 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. Nicolaides AN. Investigation of Chronic Venous Insufficiency. *Circulation*. 2000;102:126-163
2. Fraser JD, Anderson DR. Deep venous thrombosis: Recent advances and optimal investigation with US. *Radiology*. 1999;211:9-24.
3. Caso A, Zensing AWA, Wells P. Non invasive objective tests for the diagnosis of clinically suspected DVT. *Hemostasis*. 1995;170:86-90.
4. Effency DJ, Friedman MB, Gooding GAW. Iliofemoral venous thrombosis. Real time ultrasound diagnosis, normal criteria and clinical application. *Radiol* 1984;150:787-792.
5. Sumner DS, Lambeth A. Reliability of Doppler ultrasound in the diagnosis of acute venous thrombosis both above and below the knee. *Am J Surg* 1979;138:205-209.
6. Talbot SR: Use of real time imaging in identifying deep venous obstruction: A preliminary report. *Bruit* 1984;6:41-44.
7. Mattos MA, Londrey GL, Leutz DW et al: Colour flow duplex scanning for the surveillance and diagnosis of deep venous thrombosis. *Journal of vascular surgery*. 1992;15:366-376.
8. Kerr TM, Cranley JJ, Johnson JR, et al: Analysis of 1084 consecutive lower extremities involved with acute venous thrombosis scanning
9. Evans CJ et al. Prevalence of varicose veins and chronic venous insufficiency in men and women in the general population: Edinburgh Vein Study. *J Epidemiol Community Health* 1999; 53: 149-153
10. Eur J Vasc Endovasc Surg 31, 83-9 Duplex Ultrasound Investigation of the Veins in Chronic Venous Disease of the Lower Limbs—UIP Consensus Vascular Health and Risk Management 2012;8 161-167.
11. Glover J, Bendick P. Appropriate indications for venous duplex ultrasonographic examinations. *Surg* 1996;120:725-731.
12. Hill SL, Holtzman GI. The origin of lower extremity deep vein thrombi in acute venous thrombosis. *Am J Surg* 1997;173:485-490.
13. Moses KK. Pulm embolism. In Murray J, Vadel J (eds): *Respiratory medicine*. 2nd ed. Philadelphia, WB Saunders 1994; p653.
14. Engelhorn CA, Engelhorn AL, Cassou MF, et al. Pattern of saphenous venous reflux in women with primary varicose veins. *J Vasc Surg* 2005;41:645-51