Role of Doppler Examination in Deep Venous Thrombosis

Choudhary Vivek Anant[1], Patil Saurabh Shriniwas[2], Pendor Amit[3]

ABSTRACT

Introduction: Doppler ultrasonography has earned recognition as the optimal screening technique for the detection of deep venous thrombosis (DVT). Doppler using colour Doppler (CD), pulse wave Doppler and power Doppler (PD) combined with baseline grayscale (GS) ultrasound has proved to be very useful, sensitive and cheap tool to identify and characterize lesions of DVT

Material and Methods: A total of 31 patients with symptoms of DVT were subjected to Doppler examination and the patho anatomy of the lesions of DVT was mapped alongwith study of their risk factors during the period from December 2011 to December 2013.

Results: The Risk factors and Doppler features of 33 limbs in total 31 patients affected with DVT were reviewed. A total of 67.74% cases were in the age group of 30 to 60 years with the mean age being 44.29 years. 70.97% of cases were males and 29.03% were females. Symptomatically edema was found in 54.83% of cases followed by varicosities in 29.03% and pain in 25.80% of cases. Evaluation of risk factors identified prolonged hospitalization in 35.48% cases, postoperative status in 19.35% followed by OC pill usage (12.9%), trauma (9.67%) and there was 1 case of vasculotoxic snakebite and dialysis. Greatest number of thrombi were found in the femoropopliteal segments with SFV having 54.55% of cases while popliteal as well as iliac veins had thrombi in 42.42% of cases. Among the below knee veins major involvement was seen in peroneal veins (39.39%) followed by PTV (33.33%). 63.63% cases had acute episode of DVT while in 36.37% cases it was chronic. Complete thrombosis was seen in 72.72% of affected limbs while it was incomplete in 27.28% cases. Multiple contiguous segment involvement predominated with 84.85% cases followed by isolated involvement in 9.09% and the least common was multiple noncontiguous in 6.06% of cases.

Conclusion: Doppler examination proves to be a valuable modality of imaging in evaluating the characteristics, distribution, localizing, and assessing of the extent of lesions of DVT.

Keywords: Deep vein thrombosis, varicosity, pain, pulmonary embolism.

INTRODUCTION

The present day's life involves professions with long hours of standing, lack of exercise coupled with habits like smoking, improper footwear, oral contraceptive pills usage, drug abuse and alcohol consumption. Added to this is the growing burden of disorders like prolonged hospitalization, diabetes mellitus, hypertension and obesity. All these predispose the individual to deep venous thrombosis of lower limb.[1] Among venous disorders of lower limb deep vein thrombosis (DVT) is a common disorder. The triad of blood stasis, vessel wall changes and hypercoagulability is the postulated mechanism of it. The clinical manifestations of DVT are myriad like pain, swelling, edema etc and the clinical tests for suspected DVT have low sensitivity and specificity. DVT is a common cause of pulmonary thromboembolism and thus is indirectly a cause of significant mortality and morbidity. Post phlebitic syndrome is a long term complication of DVT associated with significant morbidity. DVT complicates many medical and surgical disorders like major surgery, immobilization following myocardial infarction, pregnancy related, Oral contraceptives (OC pill) usage and in hyper coagulable states.[2] Chronic venous insufficiency (CVI) occurs due to incompetence or weakness of walls of superficial veins, deep veins or perforators of lower limbs as a post DVT complication.[3,4]

Invasive contrast based investigations like venography, phlethysmography, CT venography are the various modalities used for evaluation of DVT. Ultrasonography combined with Doppler imaging has been found to useful in the mapping of vascular anatomy of lower limbs. Advantages are it is very sensitive to identify thrombus, occlusion and provide dynamic assessment of the hemodynamic status of the vessel. It is radiation free, portable, cheap and easily available. The Doppler findings in DVT are helpful for planning medical management and for post treatment surveillance.[5] This study aims to study the risk factors and evaluate the role of Doppler ultrasound examination to study characterization, classification, distribution of lower limb DVT.

MATERIAL AND METHODS

A hospital based descriptive study was conducted on 31 patients with clinical diagnosis of DVT. This study was done in Department of Radio-diagnosis and Imaging of Dr Vaishampayan Memorial Government Medical College, Solapur in a period of 2-year from December 2011 to December 2013. Prior approval of institutional ethical committee was obtained and written well informed consent of all patients was taken. Patients who were pregnant, suffering from lower limb trauma or degloving injuries or burns were excluded from the study. Ultrasound Doppler examination was performed on Siemens Acuson X 300 ultrasound machine with colour Doppler. Patient demographic and clinical history was noted

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and Doppler images were evaluated for location, characterization, degree of occlusion, and pattern of involvement looking for loss of venous compressibility, loss of colour flow, loss of waveform, absence or suboptimal augmentation of flow on distal compression.

STATISTICAL ANALYSIS

Results were calculated using standard statistical package of Stata software (Version 12 Stata corporation, Texas, USA).

RESULTS

The data were entered in master chart and analyzed using Statistical Package. The results were converted in form of graphs and pie diagrams for easy understanding and comparison. The results are displayed from Figure 1 to 8. Out of the 31 cases of DVT the range of presenting age was 17 to 82 years. A total of 67.74% cases were in the age group of 30 to 60 years with the mean age being 44.29 years (Figure 1). In the 31 cases of DVT 70.97% of cases were males and 29.03% were females (Figure 2). In the 31 cases of DVT in our study edema was found in 54.83% of cases and was the most common symptom, prolonged hospitalization was found in maximum number of cases. In our 31 (33 limbs) cases of diagnosed DVT greatest number of thrombi were found in the femoropopliteal segments. In 100% of cases of complete occlusion of veins by thrombus including acute as well as chronic cases there was loss of compressibility.

DISCUSSION

Out of the 31 cases of DVT the range of presenting age was 17 to 82 years. A total of 67.74% cases were in the age group of 30 to 60 years with the mean age being 44.29 years (Figure 1). In their study Hill et al[6] found mean age of presentation for men to be 60.3 and that for females 65.5 years. Thus DVT is commonly found in middle to old ages.

In the 31 cases of DVT 70.97% of cases were males and 29.03% were females (Figure 2). Hill SL et al[6] in their study observed that out of the all patients suspected with DVT the Doppler examination was positive in 22.1% of males while it was 15.2% in females. Our study correlates with the findings of male preponderance.

In the 31 cases of DVT in our study edema was found in 54.83% of cases and was the most common symptom. Occlusion of major vessels is the most common underlying pathology. It was followed by varicosities in 29.03% and pain in 25.80% of cases (Figure 3). These findings are in correlation with the study done by Langsfeld et al[7] who found edema to be the most common presenting symptom followed by pain. Pulmonary embolism was found in only 3.22% of cases but the thrombi in these cases were in the saphenopopliteal segments which are similar to the results of Moreno Cabral et al[8] which stated that popliteal thrombi had about twice the risk of thromboembolism as compared to below knee thrombi.

In the cases with DVT prolonged hospitalization was found in 35.48% cases, postoperative status in 19.35% followed by OC pill usage (12.9%), trauma (9.67%) and there was 1 case of vasculotoxic snakebite and dialysis (Figure 4). Anderson Jr and Spencer[9] in their study found that increasing age, bed rest > 5 days, major surgery, estrogen use, malignancies

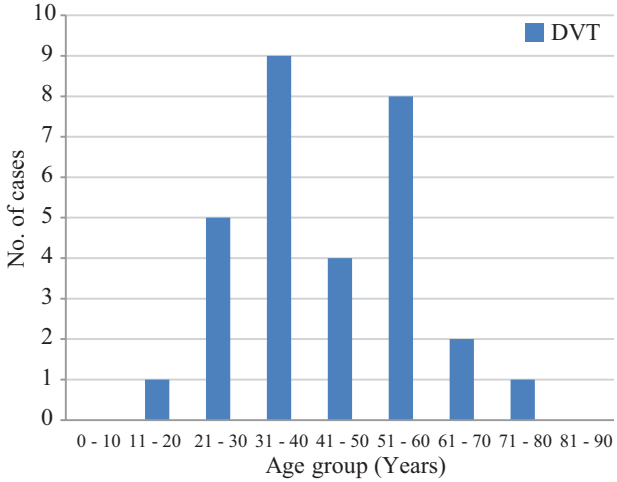

Figure-1: Age wise distribution of lower limb DVT

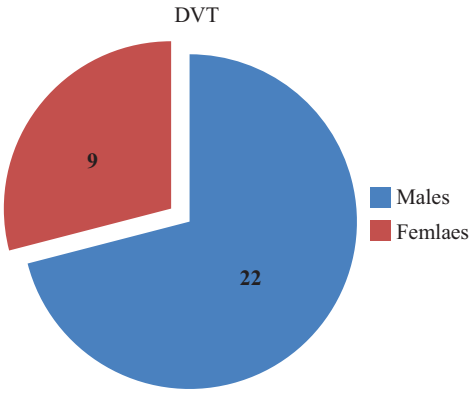

Figure-2: Sex wise distribution of lower limb vascular diseases

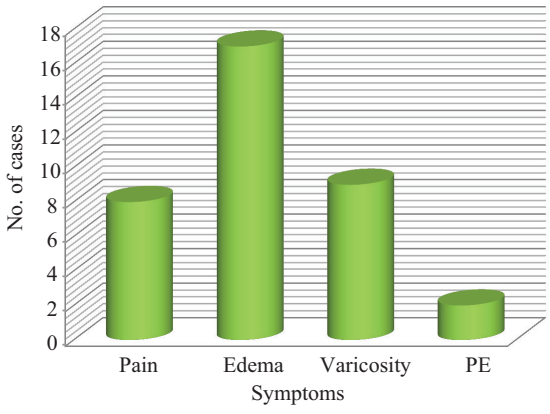

Figure-3: Symptom wise distribution in DVT (Multiple symptoms)

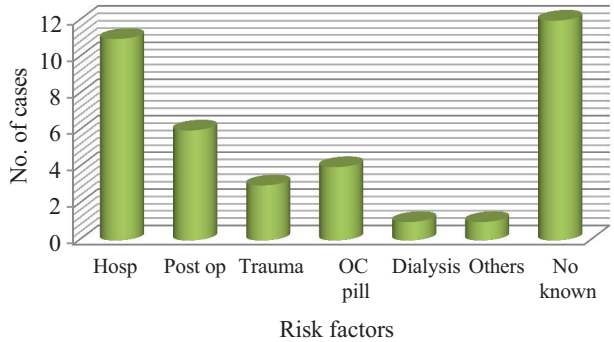

Figure-4: Clinical Conditions in patients for DVT (Multiple factors)

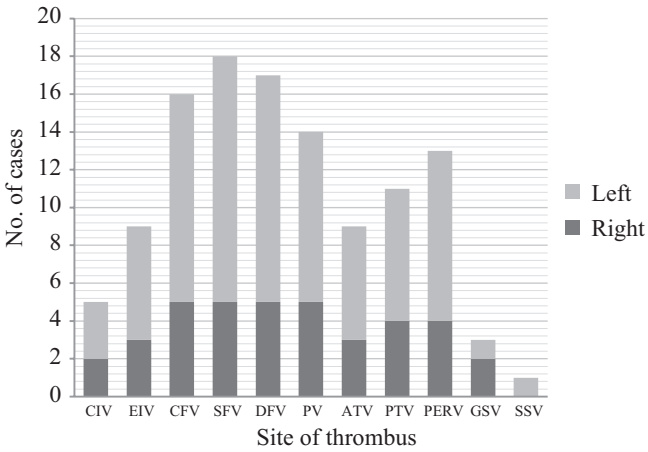

Figure-5: Site of thrombus in DVT

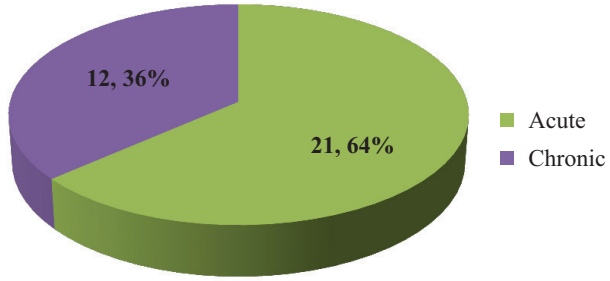

Figure-6: Stage of DVT

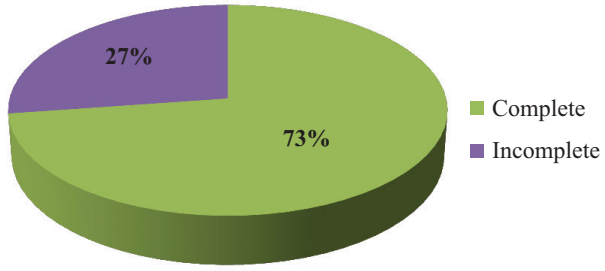

Figure-7: Type of occlusion in DVT

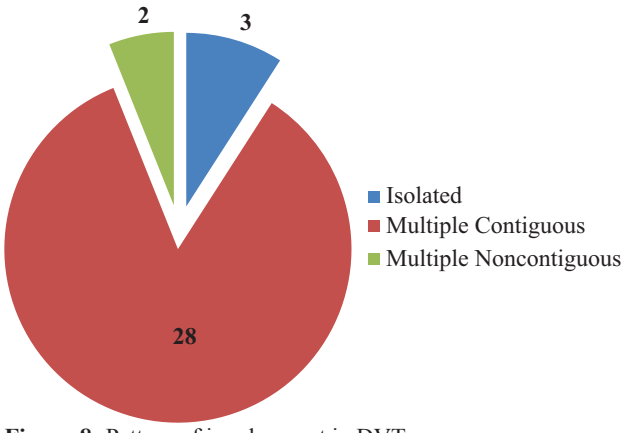

Figure-8: Pattern of involvement in DVT

were the common predisposing factors for DVT. They also found that these factors together had synergistic effect and increased the risks many more times. However in 12 cases no risk factors could be identified in our study and thus we want to emphasize the need to include a detailed history and expanded laboratory workup in all undiagnosed cases of DVT to rule out other rare causes like Protein C deficiency, antiphospholipid antibody syndrome.

In our 31 (33 limbs) cases of diagnosed DVT greatest number of thrombi were found in the femoropopliteal segments with SFV having 54.55% of cases while popliteal as well as iliac veins had thrombi in 42.42% of cases. Among the below knee veins major involvement was seen in peroneal veins (39.39%) followed by PTV (33.33%) (Figure 5).The below knee veins and superficial veins were involved alone in less number of cases. DVT of iliac or femoropopliteal veins without involving calf veins was seen in 15 (45.45%) cases which is similar to the study done by Hill et al[6] who found it in 49% patients in their study. Moreno-Cabral et al[8] in their study found that the proximal deep vein thromboses had a greater chances of causing pulmonary thromboembolism as compared to below knee thrombi. Hence the identification of the iliofemoral thrombi is of paramount importance. We had two cases of pulmonary embolism both of them had acute free floating thrombus in the femoropopliteal segments on CD imaging. Thus is important to identify as free floating thrombus is at more risk of embolism.[10]

In our study among patients with DVT 63.63% cases had acute episode while in 36.37% cases it was chronic (Figure 6). These findings are similar to the study done by Grosser et al[11] who found only 7 chronic cases by colour Doppler examination against 153 acute cases. Thus cases of acute DVT predominate in clinical settings and as they are more predisposed for pulmonary embolism we advocate routine screening with colour Doppler examination for all suspected cases of DVT. Complete thrombosis was seen in 72.72% of affected limbs while it was incomplete in 27.28% cases (Figure 7). Most of the cases with complete thrombosis were of acute variety where as incomplete thrombosis was predominated by the chronic cases. This is observed possibly due to the variable and gradual lysis of thrombus in most of the cases over a period of time.[12]

In our study three major patterns of involvement were seen. Multiple contiguous segment involvement predominated with 84.85% cases followed by isolated involvement in 9.09% and the least common was multiple noncontiguous in 6.06% of cases (Figure 8). A study done by Hill et al[6] found 52% cases with thrombi involving two contiguous segments, 34% cases of isolated thrombi and 8% thrombi extending across multiple non contiguous segments. In a study done by Stamatakis et al[13] they found in 92% of the cases the thrombi were found in calf veins either alone or in continuity with ascending veins, while only in 8% of cases the thrombi originated at multiple discontinuous sites in the leg and proximal veins. Our findings are similar to these studies.

In 100% of cases of complete occlusion of veins by thrombus including acute as well as chronic cases there was loss of compressibility. These findings are in correlation to the studies done by Appelman et al[14] who found loss of compressibility to have 96% sensitivity to identify thigh DVT. Similar findings were also found by Killewich et al[15] in their study.

The completely occluded segments had complete loss of colour flow in them while partial occluded segments displayed colour flow in the patent lumen. Absence of colour flow was seen in most of the cases of DVT in our study even in the below knee region which along with absence or suboptimal

augmentation on distal compression was found to clearly identify the thrombosed or patent venous segments in the below knee segments in more than 95% of cases. The spectral waveform pattern of completely thrombosed vein was absence of waveform while a monophasic waveform with loss of phasicity was observed in partially thrombosed or recanalised veins in around 90% of cases in our study. These findings of absence of colour flow along with loss of normal phasicity in DVT were found to have a sensitivity of 92% in a study done by Killewich et al.[15] Our results are matching with this study.

Venous distensibility is affected in DVT. In all 21 cases of acute DVT in our study had increased diameters while 8 out of the 12 cases of chronic thrombosis had diameters less than surrounding arteries. This correlated with the study done by van Gemmeren et al[16] who found significant association between the age of thrombus and venous diameter.

Limitations of this study: Sample size is not large and the cases registered were hospital based which may not be true representation of the population. Chronic complications of DVT like chronic venous insufficiency were not studied.

Future directions: Large scale population based study with long term follow up should be done.

CONCLUSION

In this study using Doppler examination it was possible to categorize the lesions of DVT along with their patho anatomy mapping. The lesions could be also classified as acute v/s chronic, significant v/s non significant occlusive. We also studied the age and sex wise distribution of the PVD with the underlying risk factors for them. Thus colour Doppler imaging is an excellent modality for DVT of lower limbs. Lastly the findings of this study correlate well with many other studies reported in literature

ABBREVIATIONS

ATV: Anterior Tibial Vein, CD: Colour Doppler, CFV: Common Femoral Vein, CIV: Common Iliac Vein, DFV: Deep Femoral Vein, DVT: Deep Vein Thrombosis, EIV: External Iliac Vein, GS: Gray Scale, OC Pills: Oral Contraceptive Pills, PD: Power Doppler, PE: Pulmonary Embolism, PERV: Peroneal Vein, PTV: Posterior Tibial Vein, PV: Popliteal Vein, SFJ: Saphenofemoral Junction, SFV: Superficial Femoral Vein

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