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COLOUR DOPPLER ULTRASOUND EVALUATION IN DEEP VEIN THROMBOSIS IN LOWER EXTREMITIES

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ABSTRACT

Introduction: Deep vein thrombosis (DVT) and its sequel, pulmonary embolism, is a significant clinical problem. Ultrasound is primary, non invasive, cheap, easily available modality for localization and characterization of the thrombus.

Aim: To evaluate the role of Color Doppler ultrasound as an imaging modality in diagnosing DVT of lower limbs.

Methods: This prospective observational study was conducted on 50 patients with clinically suspected DVT of lower extremities, referred for Color venous doppler ultrasound imaging. In the patients with positive findings, venous segment involved and the appearance of thrombus was noted.

Results: Out of 50 clinically suspected patients, out of 38 patients positive for DVT, >50% were of > 40 years of age with male predominance (55%). Main risk factors for DVT were post surgery (30%), post trauma (22%) and hypercoagulable state (pregnancy, OCPs) (16%). Thrombus was seen in 10% of external iliac vein, 22% of common femoral vein, 26% of superficial femoral veins, 23% of popliteal vein and 19% of tibial venous segments. In this study, the percentage of acute, subacute and chronic DVT was 8%, 86.8%, 5.2% respectively. Out of these,14% of veins showed partial occlusion and 86% showed complete occlusion of venous segments.

Conclusion: Color venous Doppler ultrasound was useful in diagnosing DVT in clinically suspected patients. In this study, Superficial femoral vein and Popliteal veins were most commonly involved. Subacute thrombus was most common type of thrombus found.

KEYWORDS : DVT, lower limbs, Color Doppler ultrasound, venous segment involved, type of thrombus

INTRODUCTION

The term thrombosis refers to the formation from constituents of blood of an abnormal mass within the vascular system. When this process occurs within the deep veins, it is referred to as deep vein thrombosis (DVT).[1]

Venous thrombosis, including deep vein thrombosis and pulmonary embolism, occurs at an annual incidence of about 1 per 1000 adults. Rates increase sharply after around age 45 years, and are slightly higher in men than women in older age. [2]

Deep vein thrombosis (DVT) is a disorder frequently affecting the deep veins of the lower limbs; its onset is induced by known risk factors. The natural history of DVT is a dynamic process, with both thrombolysis and thrombus extension occurring after an episode of DVT. The main complications of DVT are pulmonary embolism and post thrombotic syndrome (PST) with a mortality rate of 11-23% if not treated. [3]

The patients are clinically suspected by local symptoms like warmth, swelling, erythema and deep crampy pain in the affected extremities. When the clinical probability is intermediate or high, the venous ultrasound is performed, if result is positive, then acute symptomatic DVT is confirmed. [4]

Ultrasound (US) can also be used to confirm the diagnosis in suspected patients and to differentiate acute from chronic thrombus. In acute thrombosis, vein is distended by hypoechoic thrombus and shows partial or no compressibility without collaterals. In chronic thrombosis, the vein is incompressible, narrow and irregular and shows echogenic thrombus attached to the venous walls with development of collaterals.[5]

Advantages of lower extremity venous Duplex US are that it is readily available, quick, cost effective, noninvasive, devoid of ionizing radiation, lacks need for intravenous contrast and can be portable for critically ill patients prone for developing DVT.[6]

Till date it is believed that doppler ultrasound scanning is the non invasive technique of choice in identification of embologenic DVT. [7]

METHODOLOGY

After approval from clinical ethical committee and taking informed consent from patients, this Prospective Observational study was conducted on 50 patients with clinically suspected DVT of lower extremity, referred for Color venous Doppler ultrasound imaging to the department of RADIODIAGNOSIS at CSS Hospital, Subharti Medical College Meerut. The equipment used was Samsung Medison Accuvix A30 USG machine (Probe frequency range - Linear: HFL 7 MHz, Curvilinear: 3.5 HZ).The results were collated on Microsoft Excel spreadsheet and analyzed using SPSS Inc., Chicago version 22 and Microsoft Excel. In clinically suspected cases, DVT was diagnosed on B-mode and Color Doppler. In the patients with positive findings, the venous segment involved and the appearance of thrombus were observed. DVT in setting of neoplastic etiology and patients refusing consent to become part of this study were excluded from the study.

OBSERVATIONS AND RESULTS

The present study was conducted on 50 patients, clinically suspected for DVT of lower extremity. This study was done with Color Doppler ultrasound imaging. The present study was conducted on 50 patients, clinically suspected for DVT of lower extremity using Color Doppler ultrasound imaging. Out of 50 cases, 38 were positive for DVT. Out of these 38 cases, 21 patients (55.2%) were males and 17 patients (44.7%) were females. Mean age of total Patients in this study was 47.65 ± 20.89.The range was variable from <30years to >50 years.

In cases positive for DVT, three basic predisposing factors were venous stasis due to prolonged immobilization (due to any cause), injury to vascular wall (trauma, post surgery) and hypercoagulable state (pregnancy, Oral Contraceptive Pills).(Table 1)

Table 1: Showing Risk Factors In Total Symptomatic Patients (50) And Total Cases Positive For Dvt (n= 38)

RISK FACTORS	DVT	NORMAL	TOTAL	PRECENTAGE
PREG	2	0	2	4
TRAUMA	7	4	11	22
SURGERY	13	2	15	30
P. DVT	0	3	3	6
OCPS	3	1	4	8
SMOKING	8	0	8	16
OVER WEIGHT	5	2	7	14
TOTAL	38	12	50	100
Chi Square	14.598			
Df	6			
P value	0.024			
Significance	S			

In our study, the most common risk factors for DVT was post surgery 30%, post trauma 22% and hypercoagulable state (pregnancy, OCPs) 16%. There is significant statistical difference between symptomatic patients and patients diagnosed as positive for deep vein thrombosis.

Figure 1 shows the frequency of the lower extremity veins involved in DVT. In this study 14 patients (10%) had DVT of external illac vein, 31 patients (22%) of common femoral vein, 37 patients (26%) of superficial femoral veins, 33 patients (23%) of popliteal vein and 27 patients (19%) of tibial venous segments. So, maximum patients had DVT of superficial femoral vein.

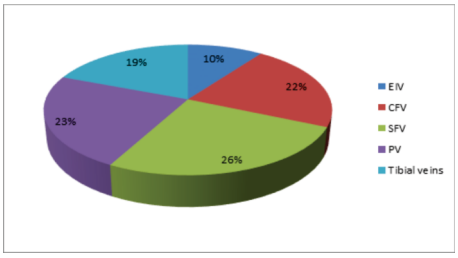

Figure 1 : Bar Graph Showing Venous Segments Involved

Figure 2 and Table 2 shows characterization of thrombus according to the caliber of the vein and echogenicity of the thrombus diving it into acute, subacute and chronic. Out of which, 8% were of acute, 86.8% of subacute while 5.2% were of chronic in nature.

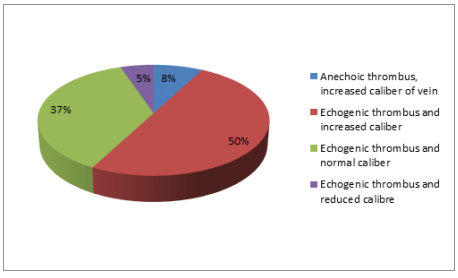

Figure 2: Pie Chart Showing Classification Of Dvt Based On Vein Caliber And Echogenicity Of Thrombus

Table 2: Classification Of Dvt Based On Vein Calibre And Echogenicity Of Thrombus

Diameter Of Vein And Echogenicity Of Thrombus	No. Of Cases	% Age	Classification
Anechoic thrombus, increased caliber of vein	3	7.8	Acute
Echogenic thrombus and increased caliber	19	50	Subacute
Echogenic thrombus and normal caliber	14	37	Subacute
Echogenic thrombus and reduced caliber	2	5.2	Chronic
Total	38	100	

Out of the involved venous segments, 7% of external iliac vein, 19% common femoral vein, 16% superficial femoral veins, 9% of popliteal veins and 15% of tibioperoneal veins had partial thrombus. 93% external iliac vein, 81% common femoral veins, 84% in superficial vein, 91% popliteal vein and 85% of Tibial venous system had total occlusion. There is no statistically significant difference in DVT patients on basis of type of thrombus as their p value is 0.717.(Table 3)

Table 3: Type Of Occlusion

Segments Involved	Partial	Partial %age	Complete	Complete %age	Total	% Age
EIV	1	7	13	93	14	100
CFV	6	19	25	81	31	100
SFV	6	16	31	84	37	100
PV	3	9	30	91	33	100
Tibial veins	4	15	23	85	27	100
Total	20	14	122	86	142	100
Chi Square	2.100					
Df	4					
P value	0.717					
Significance	NS					

DISCUSSION

The incidence of venous thrombosis (VT) increases sharply with age: it is very rare in young individuals but increases to 1% per year in the elderly, which indicates that aging is one of the strongest and most prevalent risk factor for venous thrombosis.[8],[9] Findings of present study are in concordance with the above study that DVT is more common in older age group. Out of these 38 cases, 21 patients (55.2%) were males and 17 patients (44.7%) were females.

Virchow described the consequences of a pulmonary embolus that migrated from the venous circulation, which later came to be known as Virchow's Triad. [10] Both acquired and hereditary factors play essential roles in development of venous thromboembolism. [11]-[13] The clinical conditions most closely associated with DVT are fundamentally related to the elements of Virchow's Triad; these include surgery or trauma, malignancy, prolonged immobility, pregnancy, congestive heart failure, varicose veins, obesity, advancing age, and a history of DVT. [14] Our study showed many of these risk factors.

In this study, maximum patients had DVT of superficial femoral vein(26%) followed by of common femoral vein (22%).Similarly, Khaladkar et al showed the predominant stage of DVT was that of subacute thrombus (53.8%). Superficial femoral vein was involved in 88% of the patients. The predominant type of occlusion was that of the complete type and followed by partial type.[15] Chengelis et al, the most common site of deep vein involvement was progression of disease from the greater saphenous vein in the thigh into the common femoral vein(21 patients, 70%)[16]

In our study, complete occlusion of venous segments is more common than partial occlusion. Michiels et al, Duplex criteria for complete occlusion were defined as the absence of detectable flow, either spontaneous or with augmentation, in an incompressible venous segment. Partial occlusion was defined as normal or diminished flow either spontaneous or with augmentation, in an incompletely compressible venous segment.[17]

Vululi S.T. et al categorized patients depending on the ultrasound findings: acute DVT was diagnosed in the presence of hypoechoic thrombus with limited venous compressibility; chronic DVT when there was hyper echoic or heterogeneous thrombus and limitation of venous compressibility.[18]

Zwiebel WJ et al recently formed thrombus generates only low level echoes and may virtually anechoic. The thrombus gradually becomes more echogenic throughout the subacute period. These areas are more echogenic than the adjacent muscle. Recently thrombosed veins are generally distended to an abnormally large size and are substantially larger than adjacent artery. This distension of the vein persists throughout the acute period and into the initial subacute period. In the chronic phase caliber of vein becomes reduced.[19] Garry J et al concluded that Wall thickness increases in all lower limb venous segments of patients with acute disease.[20]

In concordance to these studies, based on vein calibre and echogenicity of thrombus 7.8% had anechoic thrombus with increased caliber of vein, so they were classified as acute DVT. 50% had echogenic thrombus and increased caliber and 37% had echogenic thrombus and normal caliber, both of them were classified as subacute DVT. Echogenic thrombus and reduced caliber was seen in 5.2% of cases and were classified as chronic DVT.

CONCLUSION

This study has revealed the occurrence of lower extremity DVT to be majorly in the superficial femoral and common femoral veins. Among these, subacute type with echogenic thrombus causing increase in caliber of the veins with total occlusion of vessels was more common than chronic thrombus.

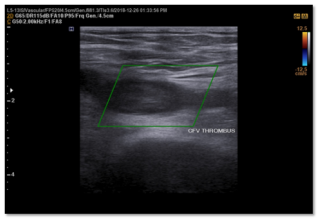

IMAGE 1: On Grey scale, longitudinal section showing echogenic thrombus distending and completely occluding the common femoral vein. No colour flow seen in Common femoral vein on colour Doppler imaging

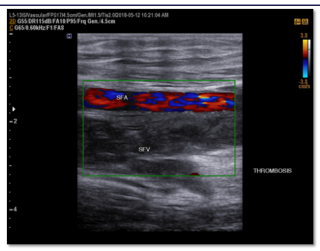

IMAGE2: Longitudinal section showing echogenic thrombus completely occluding the vein on grey scale imaging. The vein size is substantially increased as compared to the superficial femoral artery. No flow seen within superficial femoral vein on colour Doppler imaging. Normal Colour flow is seen in superficial femoral artery.

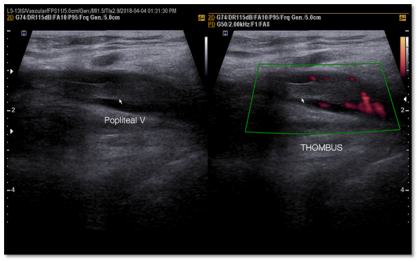

IMAGE 3: Longitudinal section (a) Grey scale (b) Colour Doppler showing echogenic thrombus distending and completely occluding the popliteal vein. No colour flow seen in popliteal vein on colour Doppler imaging

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