Lower Limbs Doppler Vascular Findings in Jos University Teaching Hospital

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***Abstract*- Background: Doppler**
Ultrasonic imaging provides a non-invasive assessment of the arterial and venous circulation in the lower limb and is accepted as a valuable diagnostic technique.

AIM: To determine the indications for Doppler imaging in the extremities in our institution and describe the main findings.

METHOD: This a retrospective study of 126 patients that had lower limb doppler interrogation for various indications in Jos university Teaching Hospital Radiology Department over a one year period(February 2012-January 2013.The results were retrieved from departmental archive. The age, sex, indications and findings were obtained and analysed.

RESULTS: A total of 126 patients were scanned in which 67 were females and 59 were males. There are more patients with DVT alone (56.3%) compared to the other indications, and it was more females compared to males (38:33). PVD constitute 19.8% of the total indications, which are more in males.

Peripheral vascular disease is the commonest positive findings. It increases with age. A good relationship between indications and findings were noted, which was significant, p of 0.003.

CONCLUSION: Ultrasonic scanning is now established as a valuable non-invasive method for investigating lower-limb vascular diseases.

I. Introduction

Doppler ultrasonic imaging provides a non-invasive assessment of the arterial and venous circulation in the lower limb and is accepted as a valuable diagnostic technique. Grey-scale images identify plaque and thrombus, duplex assessment provides a measurement of blood velocity through a vessel, and colour doppler imaging enables the rapid localization of arterial stenoses and occlusions and the identification of incompetent veins. It is hoped to provide an insight into the strengths and limitations of ultrasonic vascular investigations for those involved in tissue viability and ulcer management.[1]

Doppler US findings provide good information about the anatomy and physiology of the vessels. Spectral Doppler ultrasonography and color-flow vascular imaging supplement gray-scale US in identifying blood vessels, confirming the direction of blood flow, and detecting vascular stenosis or occlusion.

Doppler US is a valuable diagnostic test; it is inexpensive and widely available but offers detailed description of the length, severity, or type of the diseased portion of the vessel, all of which help in planning surgical or endoluminal intervention. Although vascular mapping can be performed to evaluate the iliac vessels and the femoro-popliteal vascular segments, it is time and labor consuming. It is also operator dependent. Pre-angiographic screening with color Doppler flow mapping is an accurate method for predicting the presence of femoro-popliteal artery occlusions amenable to bypass surgery. It is also a sensitive method for predicting the presence of peripheral arterial disease.[2]

In adults, the clinical conditions that predispose to Venous thrombo-embolism(VTE) are increasing age, cancer and its treatment, prolonged immobility, stroke or paralysis, previous VTE, congestive heart failure, acute infection, pregnancy or puerperium, dehydration, hormonal treatment, varicose veins, long air travel, acute inflammatory bowel disease, rheumatological disease, and nephrotic syndrome. Other acquired factors that have recently been associated with increased risk of VTE disorders include persistent elevation of D-dimer and atherosclerotic disease.[3]

DVT is a major and a common preventable cause of death worldwide. It affects approximately 0.1% of persons per year. DVT is predominantly a disease of the elderly with an incidence that rises markedly with age. [4] The incidence of VTE is low in children. Annual incidences of 0.07 to 0.14 per 10,000 children and 5.3 per 10,000 hospital admissions have been reported in Caucasian studies.[5] History and clinical examination are not reliable ways of diagnosing DVT.[6] Lower extremity DVT can be symptomatic or asymptomatic. Patients with lower extremity DVT often do not present with erythema, pain, warmth, swelling, or tenderness. Symptomatic patients with proximal DVT may present with lower extremity pain, calf tenderness, and lower extremity swelling.[7,8] Homans' sign may be demonstrable in DVT.

Peripheral vascular disease(PVD) patients are normally referred with claudication (pain on walking, particularly uphill) or with ulcers around the ankle and on clinical examination the ankle pulses are likely to be weak or absent.[14]

Occlusion is characterized by a gradual fall in blood velocity along the vessel as blood is taken away by collateral vessels. The waveform usually becomes monophasic close to the occlusion, and at the blockage the colour Doppler display shows absence of flow. The plaque causing the stenosis can be seen and the colour Doppler shows aliasing. The peak systolic blood velocity, increases from 0.26 proximally to 3.90 m/s through the stenosis, an increase by a factor of 15 indicating a very tight stenosis.[1] DVT has non-compressing veins with thrombose that are of varying echogenecity and decreased or absence blood flow. The

diameter may be normal or increased. Occasionally an embolus may be seen. PVD can be associated with calcifications, plaques and reduced caliber of the arterial diameter. Reduced blood flow and turbulence spectral pattern can be seen. Age, sex and some disease processes are known to be associated with abnormal vascular findings.[14,15]

CT angiography (CTA) and magnetic resonance angiography(MRA) are quite comparable in visualizing vessels and can provide much of the diagnostic information of the lower-extremity arteries that can be obtained with conventional angiography. These methods are invasive and expensive.The machines needed for these studies are not readily available in a developing nation like ours.

The aim of this study was to determine the indications for Doppler imaging in the lower extremities in our institution and to describe the main findings.

II. Material and Methods

The study was a retrospective analysis of all the lower limbs Doppler ultrasound scan at the Jos University Teaching Hospital (JUTH), Jos, Plateau State. Over a one year period (January 2nd 2013 to January 2nd 2014). All the lower limbs Doppler ultrasound scans were retrieved from the archive of the department after necessary approval that met the inclusion criteria. Information sought for, included patients' age, sex, indications for the scanning and outcome of the scanning.

Inclusion criteria:
(i) Patients with deep vein thrombosis as indications.
(ii) Patients with peripheral vascular diseases as indications.

The examination starts with the patient lying supine with the head slightly raised. Coupling gel is put on the thigh from groin to knee over the path of the artery. The probe was placed on the skin in the groin and the common femoral vessels identified using the colour doppler display. The scanner is switched to duplex mode, and the blood velocity waveform in the common femoral vessels was obtained. The waveform is usually biphasic or triphasic. Values significantly above normal may indicate local stenosis, while values below can indicate low flow caused by proximal or distal occlusion. The presence of any plaque intruding into the lumen is noted, and the degree of stenosis is estimated. Figures 3,4 and 5 shows a scan of a femoral artery with a protruding plaque causing about stenosis.

The vessel is scanned as far down the leg as possible and the blood velocity waveform recorded from this distal site. The position is marked on the skin. To complete the examination of the lower-limb vessels, the patient turns onto their side or front and the popliteal vessels was scanned behind the knee. Reduced velocity, decreased compressibility, absent wall to wall filling, visible intraluminal thrombi and emboli are features seen in DVT.(Figure 2). All examinations were performed using LOGIC 5, a real-time GE ultrasound machine fitted with a 10MHZ linear transducer.

Data was analysed using SPSS Version 20. Statistical parameters such as chi square, student's t-test, ANOVA and pearson's correlation were used for association between different variables. P value of <0.05 was considered statistically significant. The results were presented in the form of tables, graphs and charts.

III. RESULTS

A total of 126 patients were scanned in which (67 were females and 59 were males).There are more patients with DVT alone compared to the other indications, with more females than males. DVT with co-morbidity of HHDx and DM have equal incidence. However,DVT with HHDx is more in females and DVT with DM is more in males.

PVD constitute 19.8% of the total indications. the indications are more in males. Table I

The indications increased with age groups, with the least among those less than 30 and the highest among the ⩾60 age groups. DVT were noted more among the greater than 60 years. However,DVT with other comorbidity findings were different. DVT with HHDx was commoner in the 51-60 age group and DVT with DM was more in the 31-40 age group. PVD is commoner in >60 age group and the least age group was on the 31-40 age group. The p value is statistically significant(0.001).Table III.

The age group with the highest number of normal was 51-60 age group (56%).There was a steady increase to that age group ,after which the incidence dropped. The patients with DVT occurred more at the age group of 31-40-7(31.8%). Followed by >60 age group. PVD was noted to increase with age with the highest incidence seen at >60 age groups. Some patients had DVT and PVD, and they constituted the least in all the age groups. The findings were not statistically significant.(Table IV)

The DVT indication compared to findings showed that majority of the patients had positive findings, with DVT (37)(44.6%) being more which was closely followed by PVD(17)(20.5%).The PVD indications also showed positive findings with 14 patients. PVD was noted with the highest findings in the study population.(Table V)

IV. DISCUSSION

In this study a total of 126 patients were examined of which 67 were females and 59 were males. Deep vein thrombosis (DVT) was the commonest indication in these patients with 101 patients (80.2%) and the remaining 25 patients (19.8%) were for peripheral vascular disease (PVD). DVT is more prevalent as indications for patients that presented for Doppler scanning.

It was found that 21(18.3%) patients had DVT and of these, more males were seen with the condition. This is in contrast to the findings of Olowoyeye et al[9] and Ose-Emenim et al[10] who had much higher values. This disparity in the case of Olowoyeye et al may be due to the smaller sample population; and Ose-Emenim et al found higher values most likely because they combined lower limb DVT and carotid plagues. The overall average age- and sex-adjusted annual incidence of venous thromboembolism (VTE) is 117 per 100,000 (DVT, 48 per 100,000; PE, 69 per 100,000), with higher age-adjusted rates among males than females (130 vs 110 per 100,000, respectively). Both sexes are equally afflicted by a first VTE,

men having a higher risk of recurrent thrombosis.[5] This is similar to what we found in our study.

It was found that more females had DVT indication than males, but, more males were noted to have a diagnosis of DVT than females. This was probably due to the facts that they may have more of the risk factors for DVT. DVT rate was comparatively higher in adolescent females because of pregnancy and use of oral contraceptive agents.[5]

Diabetes mellitus and hypertensive heart diseases were noted to have association with DVT. They are chronic diseases that are known to have vascular complicatons. Of the patients examined, 15 patients with Diabetes mellitus were suspected of having DVT and of these all of them were noted to actually have DVT, with highest incidence in the 31-40 years age group (8 patients). Also, 15 patients with Hypertensive heart disease were suspected to have DVT and were found to have DVT with highest incidence in the 51-60 years age group (7 patients). This was also noted in the study done by Lowe G[11] and Tsai et al[12] that noted DM as risk factor for DVT. Wang et al[13] noted that diabetic have increased risk of DVT and it is 2.76 more in diabetics. Prandoni P[3] noted that congestive cardiac failure is a risk factor for DVT, which may occur in some patients with HHD. Our findings showed that these diseases have a strong correlation with DVT.

In this study, peripheral vascular disease was seen in 44 (38.3%) of the patients. This figure was higher than findings in similar studies where Kamar et al[14] and Udenigbo et al[15] found 29% and 24% prevalence rates respectively. Although a similar study done in [UBTH.Nigeria] Ose-Emenim et al found much higher incidence. More patients were noted to have peripheral vascular disease (44 patients) than deep vein thrombosis (21 patients). These findings show that the incidence of peripheral vascular disease is much higher in our environment than previously thought. This may largely be due to the asymptomatic nature of the disease as well as paucity of studies done in this regard.

DVT is a major and a common preventable cause of death worldwide. It affects approximately 0.1% of persons per year. DVT is predominantly a disease of the elderly with an incidence that rises markedly with age.[6]Age related findings show that the incidence of DVT was higher in the 31-40 years age group. However, our finding was at variance with that of Silverstein et al[4] that noted that deep vein thrombosis was seen more in the elderly and increased with age.

PVD increased with age with highest rate in the >60yrs age group and the least incidence was seen in the 31-40 age group. These findings are in keeping with studies done in other centres Ose-Emenim et al in University of Benin Teaching Hospital(UBTH) and Silverstein.[4] in Minnesota, which noted increase PVD with increasing age.

A combination of DVT and PVD was noted in this study among females only. It constituted < 5% of the study population. It was found in the younger age group in this study as against what was found by Silverstein.[6] where it was found more in the elderly.

In conclusion, ultrasonic scanning is now established as a valuable non-invasive method for investigating lower-limb vascular diseases. It is the first method of choice for arterial stenosis and occlusion, and for venous incompetence. It is also being used more extensively for the initial investigation of deep vein thrombosis.

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Table I:Relationship between indications and gender

Indications	Female	Male	Total	P
DVT	38(56.7)	33(55.9)	71(56.3)	0.288
DVT with HHDx	11(16.4)	4(6.8)	15(11.9)	
DVT with DM	6(9.0)	9(15.3)	15(11.9)	
PVD	12(17.9)	13(22.0)	25(19.8)	
Total	67(100.0)	59(100.0)	126(100.0)	

Table II: Relationship between findings and gender

Findings	Female	Male	Total	P
Normal	36(38.5)	31(42.0)	56(40.0)	0.159
DVT	9(13.8)	12(24.0)	21(18.3)	
PVD	27(41.5)	17(34.0)	44(38.3)	
PVT with PVD	4(6.2)	0(0.0)	4(3.5)	
Total	76(100.0)	50(100.0)	126(100.0)	

Table III: Relationship between Indications and age group

Indications	Age group					P
	≤30	31-40	41-50	51-60	>60	
DVT	4(36.4)	13(54.2)	17(63.0)	16(59.3)	21(56.8)	0.001
DVT with HHDx	1(9.1)	2(8.3)	1(3.7)	7(25.9)	4(10.8)	
DVT with DM	4(36.4)	8(33.3)	1(3.7)	0(0.0)	2(5.4)	
PVD	2(18.2)	1(4.2)	8(29.6)	4(14.8)	10(27.0)	
Total	11(100.0)	24(100.0)	27(100.0)	27(100.)	37(100.0)	

Table IV: Relationship between findings and age group

Findings	Age group					P
	≤30	31-40	41-50	51-60	>60	
Normal	4(22.2)	9(40.9)	11(42.3)	14(56.0)	10(30.3)	0.058
DVT	4(22.2)	7(31.8)	4(15.4)	3(12.0)	5(15.2)	
PVD	6(33.3)	5(22.7)	11(42.3)	8(32.0)	18(51.5)	
DVT with PVD	4(22.2)	1(4.5)	0(0.0)	0(0.0)	2(3.0)	
Total	18(100.0)	22(100.0)	26(100.0)	25(100.)	35(100.0)	

Table V: Relationship between indications and findings

Indications	Findings				
	Normal	DVT	PVD	DVT with PVD	P
DVT	28(66.7)	37(85.7)	17(41.5)	1(33.3)	0.003
DVT with HHDx	3(7.1)	1(4.8)	9(22.0)	0(0.0)	
DVT with DM	5(11.9)	2(9.5)	1(2.4)	1(33.3)	
PVD	6(14.3)	0(0.0)	14(34.1)	1(33.3)	
Total	42(100.0)	40(100.0)	41(100.0)	3(100.)	

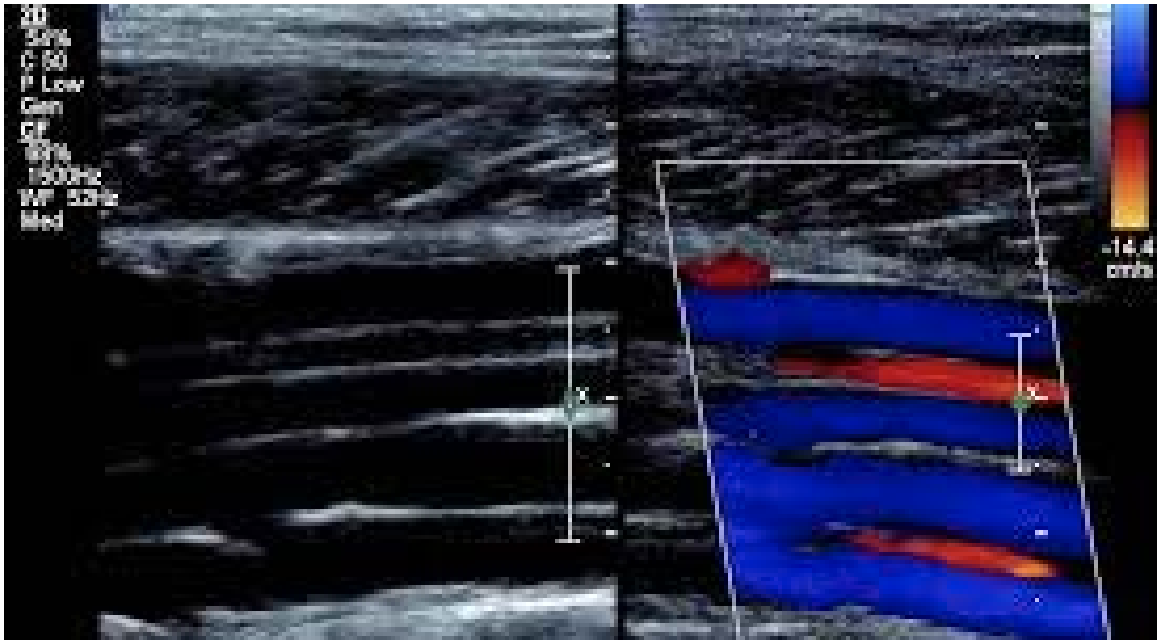

Fig !: Normal duplex scan.

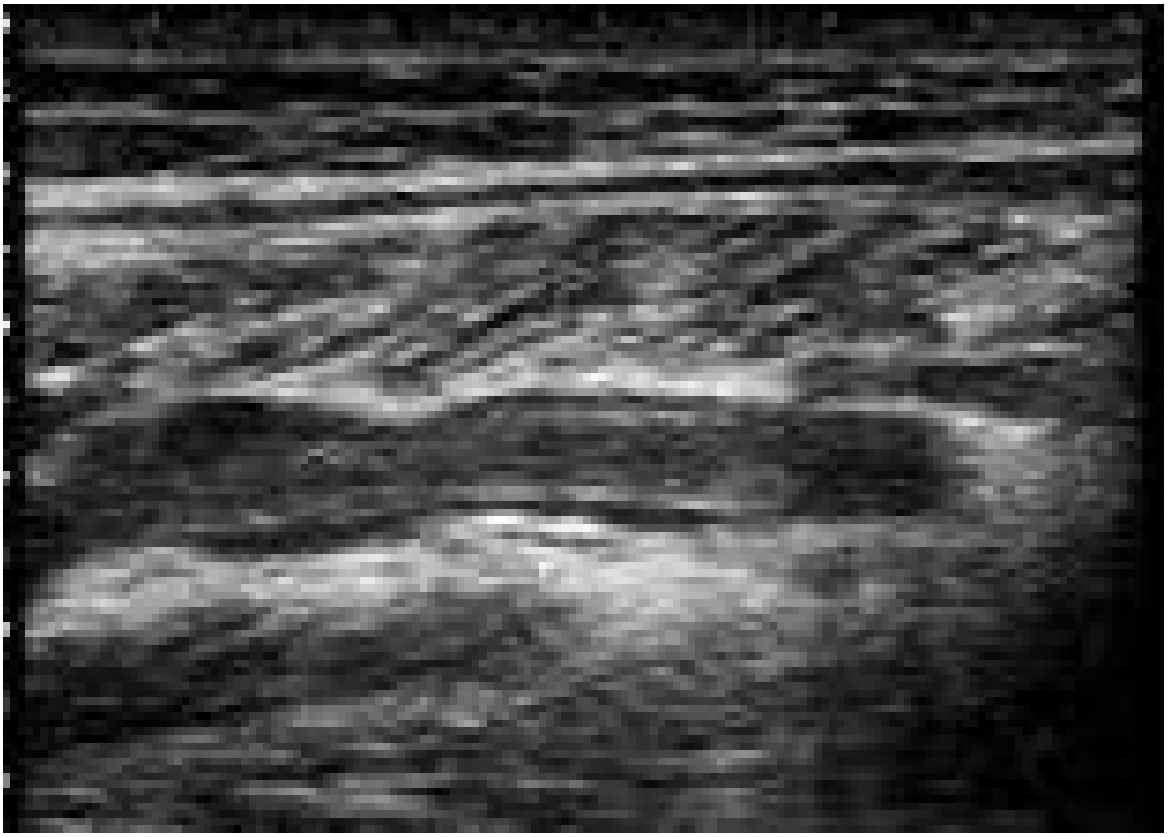

Fig.2: Doppler showing thrombose

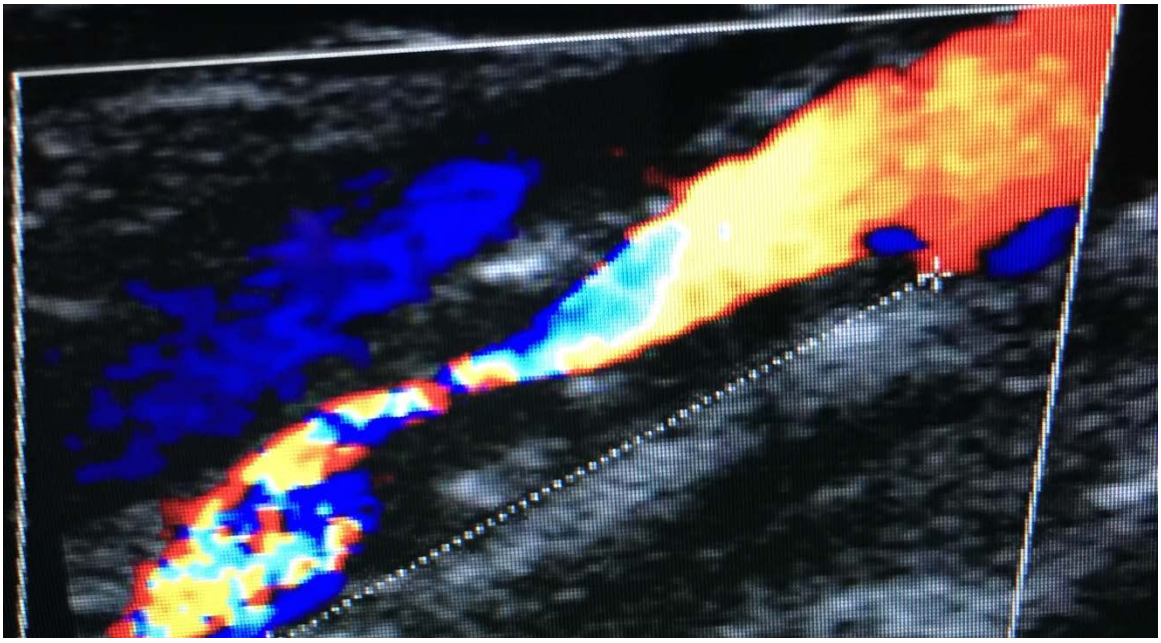

Fig 3:Colour Doppler showing arterial stenosis and turbulence pattern.

Fig 4: Multiple plagues in the arterial wall

Fig. 5: B mode doppler showing multiple arterial calcifications and irregularity.