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Original Research Article

Pattern of Findings in Doppler Ultrasound of the Lower Limb in a Tertiary Hospital in North-Western Nigeria

Gele IH[1]*, Abubakar Musa[2]

[1]Department of Radiology, Usmanu Danfodiyo University Teaching Hospital Sokoto, Nigeria
[2]Department of Radiology, Federal Medical Center Gusau, Zamfara, Nigeria

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Abstract: ***Background*:** Doppler ultrasound is a non-invasive diagnostic imaging method use for evaluation of vascular patency and abnormalities. It is readily available, cost-effective and safe with relatively no significant complication. ***Aim and Objective*:** To evaluate the pattern of findings in lower limb Doppler ultrasound in our center over the period of the study. ***Materials and Methods*:** A one year retrospective study of patients who had lower Doppler ultrasound at the Radiology department of Usmanu Danfodiyo University Teaching Hospital Sokoto, Nigeria between January – December, 2023. The patient information with regards to demographics, indication and findings were obtained from the departmental archive in the computer and the patient request cards. Additional information was also obtained from the stored images in the ultrasound machine. ***Results*:** One hundred and four patients had lower limb Doppler scan, 58 males, 46 females with a ratio of 1.2:1. The mean age was 46.5±21.3 years with a range of 1 to 100 years. Right lower limb was the most frequently affected limb accounting for 42.3% of patients. Deep venous thrombosis (36.5%), lower limb swelling (34.6%) and diabetic foot syndrome (13.5%) were the common clinical indications. DVT (34.6%), cellulitis (21.2%) and peripheral arterial disease (17.3%) were the most frequent Doppler findings. Pseudoaneurysm (5.8%) was the least abnormal finding. ***Conclusion*:** Doppler ultrasound shows high yield in detecting lower limb vascular abnormality in our locality. Deep venous thrombosis is the commonest finding in our study population.

Keywords: Doppler Ultrasound, Lower Limb, Deep venous Thrombosis, Pseudoaneurysm.

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INTRODUCTION

Doppler ultrasound is a non-invasive diagnostic imaging method use for evaluation of vascular patency and abnormalities [1]. It is readily available, cost-effective and safe with relatively no significant complication [1, 2]. It augment and in some cases replace highly specific imaging modalities such as conventional angiography, digital subtraction angiography (DSA), computed tomography angiography (CTA) and magnetic resonance angiography (MRA) [1,3].

Doppler ultrasound is a good method for screening, diagnosis and follow-up of both peripheral arterial disease and venous abnormalities of the lower limb [1,4]. Grey-scale Doppler images identify plaque and thrombus within a vessel, 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 [5-10]. Knowledge of ultrasonographic anatomy of the lower limb arteries and veins and their corresponding anatomical landmarks is essential in performing Doppler ultrasonography [1,11].

Doppler ultrasound has gained more grounds in many developing countries like Nigeria. It shows a brilliant future particularly as it relate to lower limb evaluation of deep venous thrombosis and peripheral arterial diseases [1,2,12].

This study is carried out with the aim of evaluating the pattern of findings in lower limb Doppler ultrasound in our center over the period of the study.

METHODS

This is a one year retrospective study of patients who had lower limb Doppler ultrasound at the Radiology department of Usmanu Danfodiyo University Teaching

***Corresponding Author:** Gele IH
Department of Radiology, Usmanu Danfodiyo University Teaching Hospital Sokoto, Nigeria

Hospital Sokoto between January – December, 2023. Patients were referred from the various departments of the hospital and also other facilities outside the hospital. The patient information with regards to demographics, indication and findings were obtained from the departmental archive in the computer and the patient request cards. Additional information was also obtained from the stored images in the ultrasound machine.

Techniques of Doppler Ultrasound: The Doppler examination was performed with Mindray diagnostic ultrasound system, model DC-3 (version TW.FS.9B.DN) 2012, using linear transducer (5 – 7.5 MHz). Doppler settings including angle of insonation, scale or pulse repetition frequency (PRF), baseline and filters were optimised appropriately. All patients were examined in supine position. Triplex Doppler scan comprising grey scale, colour and spectral modes was systematically employed to assess the vascular lumen and blood flow in the vessels.

In venous study for thrombosis, compression and augmentation procedures were employed, while additional Valsalva manoeuvre was used for evaluation of valve competency. In evaluation of the arteries, the following indices were assessed. The intimal media thickness, presence or absent of intimal calcification, plaques or artheroma and the colour pattern on colour Doppler mode. The spectral waveform was used to measure the peak systolic velocity (PSV), end diastolic velocity (EDV).

All findings were recorded in a result worksheet and analyzed using statistical package for social sciences (SPSS) version 20. Analysis with descriptive statistics using mean and standard deviation (SD) for quantitative data and frequencies for qualitative data were done. This was followed by inferential statistics using Chi square test to determine associations between categorical variables.

The results were presented in form of tables. All statistical tests were carried out using a two tail test, with level of significance set at 0.05.

RESULTS

A total of 104 patients who had Doppler ultrasound of the lower limb over one year period were studied. Fifty eight (55.8%) of the patients were male and 46 (44.2%) were female with a ratio of 1.2:1. The mean age was 46.5±21.3 years with a range of 1 to 100 years.

Right lower limb was the most frequently affected limb accounting for 42.3% of patients, followed by the left lower limb 38.5%, while both limbs were affected in 19.2% as shown in table 1.

Table 1: Limb affectation

Limb	Frequency %
Right lower limb	42.3
Left lower limb	38.5
Bilateral limbs	19.2
Total	**100**

Deep venous thrombosis (DVT) was the most common clinical indication for requesting Doppler ultrasound within the period under review accounting for 38 (36.5%) patients. Lower limb swelling followed closely with 36 (34.6%) patients. Diabetic foot syndrome (DFS) was recorded indication in 14 (13.5%) patients, while PAD and trauma were 8 (7.7%) and 6 (5.8%) indications respectively.

Of the total number of patients that had Doppler examination, 36 (34.6%) was found to have DVT, 22 (21.2%) accounted for cellulitis, while 18(17.3%) and 8 (7.7%) were found to have PAD and venous insufficiency respectively. The least abnormal finding is pseudoaneurysm in 6 (5.8%), while 8 (7.7%) accounted for other findings such as soft tissue haemangioma and Baker's cyst (table 2). Most of the abnormal findings (38) were recorded in the 41 – 60 age group. There was no statistically significant association (p = 0.198) between the age group of patients and Doppler findings.

Comparison of clinical indication for the examination and Doppler findings shows that, out of 38 patient with clinical indication of DVT, confirmatory findings of DVT was recorded in 26 (68.5%) patients, 8 (21%) had cellulitis while 4 (10.5%) were normal findings. Fourteen (38.9%) out of the total number of 36 with indication of leg swelling had findings of cellulitis, while DVT and venous insufficiency accounted for 8 (22.2%) and 6 (16.7%) respectively. Of the 14 patients with DFS, 8 (57.1%) and 2 (14.2%) patients had positive findings of PAD and DVT respectively. The entire 6 patients with trauma were found to have pseudoaneurysm (table 2).

Table 2: Relationship of clinical indication and Doppler Findings

Indication	Doppler Findings							
	DVT	PAD	Cellulitis	VI	Pseudo Aneurysm	Others	Normal	Total
DVT	26	0	8	0	0	0	4	38
DFS	2	8	0	0	0	4	0	14
PAD	0	8	0	0	0	0	0	8
Leg swelling	8	2	14	6	0	4	2	36
Trauma	0	0	0	0	6	0	0	6
Leg pain	0	0	0	2	0	0	0	2

Indication			Doppler	Findings				
	DVT	PAD	Cellulitis	VI	Pseudo Aneurysm	Others	Normal	Total
Total	36	18	22	8	6	8	6	104

DVT: Deep vein thrombosis, PAD: Peripheral arterial disease, VI: Venous insufficiency

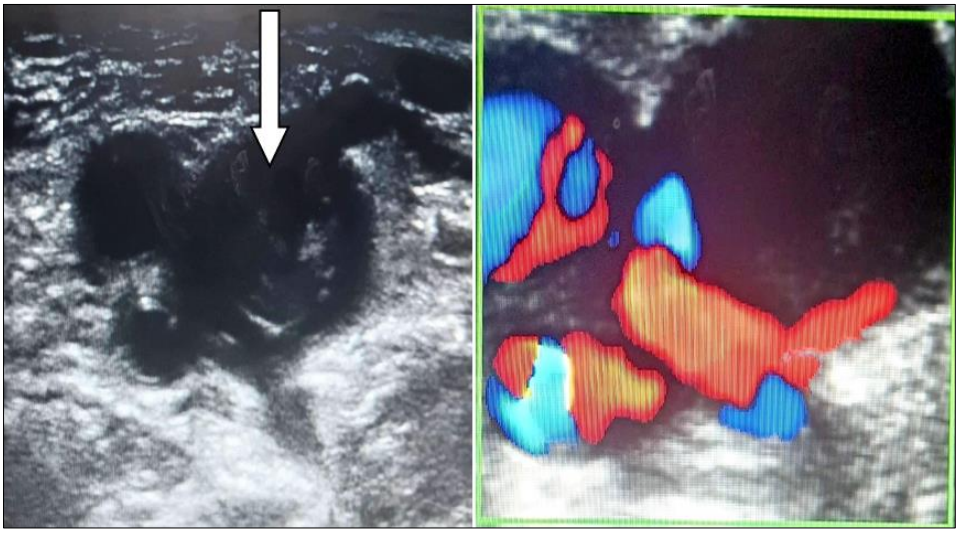


Figure 1: Grey scale and colour Doppler sonograms of the left common femoral vein and artery showing echogenic thrombus in the vein (arrow). Note the absent of flow in the vein on colour interrogation

DISCUSSION

Doppler ultrasonography remains an important non-invasive technique for evaluation of the vascular diseases of the lower limb. It does not require the use of ionizing radiation or iodinated contrast medium [1,13]. Furthermore, it is a good method for screening and follow-up of patients, as well as for definitive diagnosis of some vascular diseases like DVT and PAD [1,11,14].

This study involved 104 patients, with a preponderance of males (M:F=58:46). This is similar to the findings of Olatunji *et al*., in Sagamu, Ikpeme *et al*., in Calabar and Msuega *et al*., in Makurdi, Nigeria in which they recorded male to female ratio of 29:13, 51:25 and 106:94 respectively [2,13,15]. However, our findings is in contrast to the findings of similar studies by Salaam *et al*., at university of Jos teaching hospital and Ehigiamusoe *et al*., in Benin, Nigeria, in which they reported more females with ratio of M:F=59:67 and M:F =79:125 respectively [7,11]. The preponderance of male in most of these studies may be due to the increased incidence of vascular lesions in the males as reported in previous studies [2,16]. The mean age in our study is 46.5 years which is similar to some lower limb Doppler studies done in Nigeria [17,18].

In this study, DVT was the most common indication for Doppler evaluation of the lower limb accounting for 36.5% of the patients. This is followed by lower limb swelling (34.6%) and diabetic foot syndrome (13.5%). Our finding is in agreement with the findings of Salaam *et al.,* in Jos Northern Nigeria who studied 126 patients and reported DVT as the commonest clinical indication (80.2%) followed by PAD with 19.8%. However, the finding in this study is at variance with that of Olatunji *et al*., in Sagamu Southern Nigeria in which they studied 42 patients and reported diabetic foot syndrome as the commonest indication (54.74%) followed by DVT with 19.04%. The difference between our study and that of Olatunji *et al*., may be due to regional variation in the prevalence of diabetes mellitus which predisposed patients to foot ulcers. It may also be due to lower sample size used in their study compared to our study [7,13].

The right lower limb was the predominant limb involved in our study (42.3%). This was followed by the left lower limb with 38.5% and then both lower limbs in 19.2% of cases. The predominance of right lower limb in the index case is at variance with previous studies in which they reported left lower limb predominance [17-19]. The reason for this variability is presumably due to evaluation for only deep venous thrombosis in their studies as oppose to our study in which we evaluated for both arterial and venous abnormalities. It was also reported that compression of the left common iliac vein by the right common iliac artery has been implicated as a plausible explanation for the observed left lower limb predominance in their study [21, 22].

Deep venous thrombosis (DVT) is the formation of blood clots or thrombus within the deep veins of the body and mostly affects the lower limb. It is the most common preventable cause of death amongst the hospitalized patients in developed countries [19, 20]. DVT (fig. 1) was the commonest findings in the index study (34.6%) and are of equal proportion in males and females. The findings of DVT in the majority of patients in our study is consistent with the findings of Msuega *et*

al., and Salaam *et al.,* in the northern part of Nigeria who also reported DVT as the commonest finding in their studies [2,7]. However, our finding is not in agreement with the findings of Olatunji *et al*., and Ehigiamusoe *et al.,* in the southern part of Nigeria who reported DVT as second most common findings [11,13]. Emmanuel *et al*., in Ghana reported DVT as third most common finding after cellulitis and inguinal lymphadenopathy [19]. The reason for this difference in sonographic findings may be due to regional variation.

Cellulitis was a significant finding in the index study and was second after DVT. Cellulitis was found in more than one third of patients with clinical indication of leg swelling. This finding is close to the finding of Emmanuel at al who also reported higher cases of cellulitis in their study [19]. Peripheral arterial disease appears to be less common finding in our environment as it account for only 17.3 % of all the cases studied. Other less common findings includes venous insufficiency and pseudoaneurysm. However, only 6 (5.8%) patients out of the total number of studied population had normal examination and this signifies high yield of Doppler examination in diagnosing vascular abnormalities of the lower limb in our environment.

CONCLUSION

Doppler ultrasound is a non-invasive diagnostic imaging method use for evaluation of vascular patency and abnormalities. It shows high yield in detecting lower limb vascular abnormality in our locality. Deep venous thrombosis is commonest finding in our study population.

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