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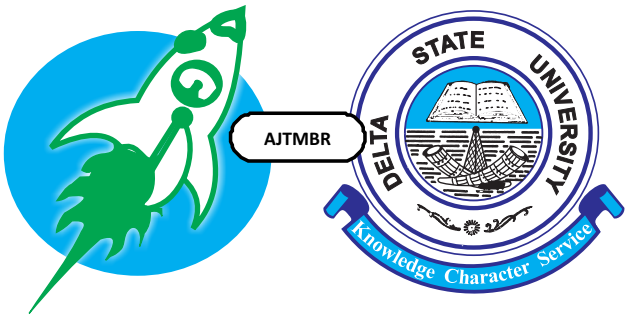

The Journal is the Official Publication of the College of Health Sciences, Delta State University, Abraka, Nigeria.

ISSN: 2141-6397

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The African Journal of Tropical Medicine and Biomedical Research is a multidisciplinary and international journal published by the College of Health Sciences, Delta State University of Abraka, Nigeria. It provides a forum for Authors working in Africa to share their research findings on all aspects of Tropical Medicine and Biomedical Sciences and to disseminate innovative, relevant and useful information on tropical medicine and biomedical sciences throughout the continent. The journal will publish original research articles, reviews, editorials, commentaries, short reports, case reports and letters to the editor. Articles are welcome in all branches of medicine and dentistry including basic sciences (Anatomy, Biochemistry, Physiology, Pharmacology, Psychology, Nursing etc) and clinical sciences (Internal Medicine, Surgery, Obstetrics and Gynaecology, Dental surgery, Child Health, Laboratory Sciences, Radiology, Community Medicine, etc). Articles are also welcome from social science researchers that document the intermediating and background social factors influencing health in countries of Africa. Priority will be given to publication of articles that describe the application of the principles of primary health care in the prevention and treatment of diseases.

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The title page should include the following information: 1. the title and sub-title; 2. the name(s) of the author(s); 3. the affiliation(s) of the author(s); 4. name and address of the corresponding author and 5. three to six key words for indexing and retrieval purposes.

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Table of Contents

Spectrum of Findings in Lower Limb Doppler Ultrasonography in UBTH, Benin City

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Abstract

Objectives: Doppler ultrasonography (USS) is a relatively new radiological procedure in our environment but gradually gaining recognition in assessment of lower limb pathologies. This study aims to assess the pattern of referrals for lower limb Doppler USS and the outcome of the procedure at the University of Benin teaching hospital

Materials and Methods: This was a retrospective study carried out at the University of Benin teaching hospital, between January 2018 and June 2019. The request forms and Doppler scan results of patients done within this period were retrieved and relevant information were obtained and analyzed using statistical package for social sciences, version 23.

Results: A total of 204 patients comprising of 125 females (61.3%) and 79 males (38.7%) were analyzed in this study. Mean age of study population was 55.25±17.02 years. The commonest indication for lower limb Doppler scan was leg swelling (70, 22.8%) while the least was peripheral arterial disease (PAD) (14, 4.6%)

The commonest Doppler ultrasound finding was PAD (74, 44.3%), followed by DVT (39, 23.4%). The least findings on Doppler ultrasound of the lower limb was arterio-venous malformation (AV) malformation (1, 0.6%). Arterial wall calcification (100%) was the commonest Doppler finding in patients with PAD. DVT occurred more in the left lower limb (67.7%) than right limb (32.3%) and superficial femoral vein (27.8%) was most affected.

Conclusion: This study has shown that Doppler scan is quite relevant in lower limb pathologies and peripheral artery disease is the commonest diagnosis in the lower limb.

Keywords: Spectrum, Lower limb, Doppler, ultrasonography.

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INTRODUCTION

The common presenting symptoms and elicited signs of the lower limbs vascular diseases include leg swelling, leg pain and leg ulcers. Other systemic chronic conditions associated with increased age and prolonged lifespan such as hypertension and diabetes could also cause vascular diseases of the lower limb.

Lower limb vascular diseases involving both arteries and veins can be evaluated using Doppler ultrasonography. Some indications for the use of Doppler ultrasonography include; assessment of disease in patients with ischemic symptoms, follow-up of by-pass graft procedures, follow-up of angioplasty procedures, diagnosis and follow-up of aneurysms of the peripheral arteries, diagnosis and treatment of false aneurysms, diagnosis of pulsatile lesions, assessment of dialysis shunts, diagnosis or exclusion of DVT, assessment of secondary/

recurrent varicose veins, investigation of chronic venous insufficiency and post phlebitis syndrome, vein mapping prior to bypass grafts, assessment of primary varicose veins and localization of veins for cannulation[1].

Imaging modalities for evaluating the lower limb vessels include computed tomography (CT) angiography, catheter angiography, and Doppler ultrasonography. Three-dimensional CT angiography provides information about atherosclerotic calcifications and the extent of stenosis or occlusion of the vessels. CT angiography has some advantages, such as a shorter evaluation time and the fact that it is less affected by operator's experience. Catheter angiography is used for arterial vascular interventions and it is the gold standard in the diagnosis of peripheral arterial disease[2,3]. However, Doppler ultrasonography remains the only non-invasive technique that does not require contrast medium, preparation of the patient before the study is carried out, or radiation exposure[4]. Furthermore, it is a good method for screening and follow-up, as well as some definitive diagnosis of some vascular diseases like PAD and DVT. DVT has an incidence of about 80-100/100,000 annually in the general population of Western countries but its incidence is relatively unknown in the general population in Nigeria[5]. DVT is the formation of thrombus in the deep veins, mostly affecting the lower limbs; the attendant risk of pulmonary thromboembolism confers on it the need for quick diagnosis and treatment. DVT particularly of the proximal veins is better diagnosed using color Doppler investigation, which combines the advantages of compression sonography with the ability to visualize venous flow in color without the injection of contrast material[6]. The biochemical investigative method of using D-dimer assay may be sensitive but it is not very specific, also a conventional venography may detect a thrombus in the vein, it is however an invasive procedure[7,8]. PAD defines presence of narrowing of the arteries due to atherosclerotic changes with resultant reduction in the blood flow and this shows an incidence of about 25-45% in the Nigeria population [9,10].

Knowledge of ultrasonographic anatomy of the lower limb vessels and the corresponding anatomical landmarks is essential in performing Doppler ultrasonography[4].

The University of Teaching Hospital is a multidisciplinary tertiary health institution with very efficient endocrinology, vascular surgery and plastic surgery units, hence referrals are sent to the Radiology department for lower limb Doppler ultrasonography, which has helped these specialists to better manage their patients with lower limb vascular diseases. The aim of this study is to document the common indications and Doppler scan findings of lower limb diseases at the University of Benin Teaching Hospital.

MATERIALS AND METHODS

This is a cross sectional retrospective study of all lower limbs Doppler scans done at the Radiology department of the University of Benin Teaching hospital between January 2018 and June 2019. Ethical clearance for the study was obtained from the Ethics and research committee of the University of Benin Teaching Hospital. All scans were done using a linear probe (5-7MHz) of a Sonoace Medison X6 ultrasound machine (Korea, 2009) with Doppler facility. The ultrasound request forms and the results of all Doppler scans done for lower limbs within the stated period were retrieved from our archive. Only the ones with complete biodata, clinical findings and ultrasound findings were agreed upon by the authors and thereafter enrolled into the study. The biodata, indications for Doppler scan and Doppler scan findings of all those

enrolled were entered into Statistical package for social sciences (SPSS) version 23(IBM, Chicago,IL) and analyzed. Test of significance was done with Chi squared test. Confidence interval of 95% was used with P-value set at less than or equal to 0.05 to be considered statistically significant.

RESULTS

A total of 204 patients comprising of 125 females (61.3%) and 79 males (38.7%) were analyzed in this study. Mean age of study population was 55.25±17.02 years with that of the males being 54.96±17.16 years and females being 55.42±16.99 years. Patients in age group 41-60 years (40.2%) were more in this study while those in age group 1-20 years were least (2.5%)- table 1.

The most common indication for lower limb Doppler scan was leg swelling (70, 22.8%), followed by deep vein thrombosis, DVT (45, 14.7%), leg ulcer (43, 14.0%), diabetic foot (38, 12.4%), leg pain (20, 6.5%), cellulitis (18, 5.9%) and peripheral arterial disease, PAD (14, 4.6%). The least indication was heart failure (0.3%)- table 2

Leg swelling as the most common indication was more in age groups 41-60 years and 61-80years and this was seen to be significant (P=0.042). DVT as an indication for lower limb Doppler scan was next to leg swelling and was seen more in age group 61-80 years. Other indications such as leg ulcer, leg pain, diabetic foot and cellulitis were also seen more in age group 61-80 years, though not statistically significant-table 3.

The most common Doppler ultrasound finding was PAD (74, 44.3%), followed by DVT (39, 23.4%), varicose vein (21, 12.6%) and cellulitis (18, 10.8%). These were subsequently followed by arterial thrombosis (7, 4.2%) and lymphedema (6, 3.6%). The least findings on Doppler ultrasound of the lower limb were AV malformations, perivascular abscess and rhabdomyosarcoma which had one case each (0.6%)-tables 5&6.

All Doppler findings were more in females than males except arterial thrombosis. PAD and DVT were seen more in age group 61-80 years whereas; varicose veins were more in age group 41-60 years-Table 7.

Peripheral arterial disease (PAD) was the most common ultrasound diagnosis in patients that presented with leg ulcer (58.1%), leg gangrene (85.7%), diabetic foot (78.9%) and cellulitis (38.9%). Out of the 14 patients that presented with PAD, majority had Doppler evidence of PAD, 10 (71.4%). DVT was the most common Doppler finding in those that presented with leg swelling (44.0%), followed by those that presented with leg ulcer (4.6%), gangrene (14.3%), leg pain (25%) and diabetic foot (5.3%) respectively. The only two cases of pelvic fracture seen in this study had DVT on Doppler interrogation. Out of the 45 patients that presented with DVT only 27 (60%) were confirmed on Doppler scan-Table 8.

DVT occurred more in the left lower limb (67.7%) than right lower limb (32.3%) for all lower limb veins and this was very significant (P<0.000). Superficial femoral vein (27.8%) was most affected followed by popliteal vein (23.1%). The lower limb deep vein least affected by DVT was calf vein (11.1%)-Table 9.

Incompetent perforating vein were seen more than incompetent saphenous-femoral venous valves in patients that presented with varicose veins-Table 10.

Table 1: Age and sex distribution

Age group	Frequency (%)
1-20	5 (2.5)
21-40	37 (18.1)
41-60	82 (40.2)
61-80	67 (32.8)
80-100	13 (6.4)
Sex	
Male	79 (38.7)
Female	125 (61.3)

Mean Age: 55.25±17.02yr, Males: 54.96±17.16yr, Female: 55.42±16.99yr

Table 2: Indications for lower limb Doppler scan

Indications	Frequency (%)
Leg swelling	70 (22.8)
Leg ulcer	43 (14.0)
DVT	45 (14.7)
Diabetic foot	38 (12.4)
Leg pain	20 (6.5)
Cellulitis	18 (5.9)
PAD	14 (4.6)
Varicose vein	9 (2.9)
Gangrene	7 (2.3)
Ischemic stroke	5 (1.6)
Gunshot injury	4 (1.3)
Difficulty with walking	4(1.3)
Lymphedema	4(1.3)
Trauma	4 (1.3)
Pulmonary embolism	2 (0.7)
Peripheral neuropathy	2 (0.7)
Pelvic fracture	2 (0.7)
Traumatic AV fistulae	2 (0.7)
Screening	2 (0.7)
Vascular tumor	2 (0.7)
DM nephropathy	3 (1.0)
Pelvic varicocele	2 (0.7)
Nephrotic syndrome	2 (0.7)
Aneurysm	2 (0.7)
Heart failure	1 (0.3)

Table 3: Age group versus indications for lower limb Doppler scans

Indications	1-20	21-40	41-60	61-80	81-100	Total	P-value
Leg ulcer	0	6	15	18	4	43	0.364
Leg pain	0	3	7	8	2	20	0.806
Leg swelling	3	18	24	24	1	70	**0.042***
Diabetic foot	0	6	12	18	2	38	0.264
PAD	0	1	8	3	2	14	0.340
DVT	0	9	17	18	1	45	0.397
Cellulitis	0	2	5	9	2	18	0.374
Leg gangrene	0	0	2	3	2	7	0.109
Varicose vein	0	1	6	2	0	9	0.549

Table 4: Sex distribution of indications for lower limb Doppler scan

Indications	Male	Female	Total	P value
Leg ulcer	15 (34.9)	28 (65.1)	43	0.601
Leg pain	2 (10.0)	18 (90.0)	20	**0.006***
Leg swelling	25 (35.7)	45 (64.3)	70	0.548
Diabetic foot	14 (36.8)	24 (63.2)	38	0.855
Peripheral arterial disease	5 (36.8)	9 (63.2)	14	1.000
Cellulitis	5 (27.8)	13 (72.2)	18	0.448
Leg gangrene	2 (22.2)	7 (77.8)	9	0.708
Varicose vein	2 (22.2)	7 (77.8)	9	0.487
Deep vein thrombosis	20 (44.4)	25 (55.6)	45	0.390

Table 5: Sex distribution of findings on lower limb Doppler scan

Findings	Male	Female	Total
Arterial calcification	26	48	74
Peripheral arterial disease	26	48	74
SC edema	26	47	73
Atheromatous plaque	15	29	44
Arterial stenosis	16	24	40
DVT	16	24	39
Varicose vein	7	14	21
Fasciitis/Cellulitis	6	12	18
Incompetent perforators	4	12	16
Arrhythmia	1	7	8
Arterial thrombosis	5	2	7
Lymphedema	2	4	6
Incompetent SFJ	1	3	4
Subvalvular thrombosis	1	2	3
Rhabdomyosarcoma	1	0	1
Perivascular abscess	1	0	1
Pyomyositis	0	2	2
Baker's cyst	1	3	4
Arterio-venous malformation	1	0	1

Table 7: Age distribution of Doppler ultrasound findings

Findings	1-20	21-40	41-60	61-80	81-100	Total	P-value
Peripheral arterial disease	0	6	26	32	10	74	**0.000***
Subcutaneous oedema	3	16	30	22	2	73	0.308
Deep vein thrombosis	0	8	14	16	1	39	0.458
Varicose vein	1	2	12	6	0	21	0.313
Cellulitis	1	4	6	6	1	18	0.876
Incompetent perforators	0	1	10	5	0	16	0.531
Arrhythmias	0	0	2	3	3	8	0.005
Incompetent SFJ	0	1	2	1	0	4	0.959

Table 8: Some indications versus Doppler ultrasound findings.

Indications	Doppler findings
Leg ulcer	PAD (25, 58. 1%), varicose veins (10, 23.3%), cellulitis (4, 9.3%), DVT (2, 4.6%), Pyomyositis (1, 2.3%), normal (1, 2.3%)
Leg swelling	DVT(22, 44.0%), PAD (12, 24%), varicose vein (5, 5.0%), lymphedema (5, 5.0%), arterial thrombosis (1, 2.0%), Pyomyositis (1, 2.0%), normal (4, 8.0%)
Gangrene	PAD (6, 85.7%), DVT (1, 14.3%)
Leg pain	PAD (8, 40%), DVT (5, 25%), lymphedema (1, 5%), cellulitis (1, 5%), normal (5, 25%).
Diabetic foot	PAD (30, 78.9%), cellulitis (4, 10.5%), DVT (2, 5.3%), arterial thrombosis (2, 5.3%).
Peripheral arterial disease (PAD)	PAD (10, 71.4%), DVT (1, 7.1%), arterial thrombosis (1, 7.1%), lymphedema (1, 7.1%), normal (1, 7.1%).
Varicose vein	Varicose vein (5, 55.6%), DVT (3, 33.3%), normal (1, 11.1%).
Deep vein thrombosis (DVT)	DVT (27, 60 %), PAD (2, 4.4%), varicose vein (2, 44.4%), cellulitis (1, 22.2%), normal (13, 28.9%)
Cellulitis	PAD (7, 38.9%), cellulitis (4, 22.2%), arterial thrombosis (1, 5.6%), normal (6, 33.3%)
Pelvic fracture	DVT (2,100%)

Table 9: Distribution of DVT on lower limbs

Vein	Right	Left	Both	Total (%)	P value
External iliac	0	5	0	5 (4.6)	**0.000***
Common femoral	4	13	2	19(17.6)	**0.000***
Superficial femoral	8	17	5	30(27.8)	**0.000***
Deep femoral	4	8	2	14(12.9)	**0.000***
Popliteal	8	13	4	25(23.1)	**0.000***
Calf vein	5	5	2	12(11.1)	**0.000***
Long saphenous	1	2	0	3(2.8)	**0.000***

Table 10: Distribution of predisposing factors to varicose vein

	Incompetent perforator	Incompetent sapheno -femoral venous valve
Varicose vein	14	4
No varicose vein	2	0

DISCUSSION

The lower limb is an essential part of the human body for mobility and disease entity of any sort of this part could render an individual moribund. Vascular disease of the lower limb is one of such entities that demand prompt diagnosis and treatment and Doppler ultrasonography has become a frontline imaging modality in this respect as it is non-invasive, non-ionizing and portable.

The mean age of our study population was 55.2517.02 years which is similar to some studies done in the North-western and Southern parts of Nigeria[11,12,13.] There was significant female preponderance in our index study with 61.3% female population, this is in contrast to previous similar studies done by Misauno *et al*[6] at the University of Jos Teaching Hospital that showed 47.9% female population and that done by Igbinedion *et al*[13] at the University of Benin Teaching Hospital that showed 49.6% female population. This difference could be due to the fact that there is better awareness on health issues amongst the female population now compared to previous times[14,15].

Leg swelling was the most common indication for Doppler evaluation of the lower limb in our study accounting for 22.8% of the total study population. This observation is in tandem with previous studies[12,13] but in contrast to the study done by Misauno *et al*[6] at Jos University Teaching hospital where DVT was the commonest indication for Doppler ultrasound. Leg swelling can be the symptom of many local diseases such as DVT and cellulitis and systemic diseases such as renal failure and cardiovascular compromise[16]. Furthermore, our study showed DVT as the most common ultrasound finding in patients that presented with leg swelling. This could account for leg swelling being the most common indication for lower limb Doppler scan in our study.

DVT was next to leg swelling in terms of indication for lower limb Doppler interrogation, and was more in the 61- 89 years age group. Old age is a known risk factor for developing DVT. Furthermore, the elderly are prone to developing co-morbidities which are also risk factors for DVT [17]. Hence, the more DVT seen in this age group.

Other indications for Doppler evaluation of the lower limb, such as leg ulcer, leg pain, diabetic foot and cellulitis were also seen more in age group 61-80 years. It was noticed that these indications affect the middle aged and the elderly, this is most likely due to the fact that among older adults, there are age-related alterations in vascular structure and function, which are compounded by longer exposure to cardiovascular disease risk factors, resulting in increased incidence and prevalence of peripheral arterial disease and venous thromboembolism[18].

The commonest Doppler findings in our study were PAD (74, 44.3%) and DVT (39, 23.4%). This is comparable to a similar study done by

Igbinedion *et al*[13] which showed peripheral vascular disease as the commonest Doppler diagnosis. This similarity may be due to the fact that it's same locality and Doppler scan services have been consistent since then till now. Furthermore, patients in the older age group were more in this study and old age is a risk factor for developing peripheral arterial disease [19]. But it is in contradistinction to the study by Ikpeme *et al*[12] in Calabar, Nigeria where chronic venous insufficiency was the most common Doppler diagnosis. The difference in the locality and the fewer number of patients (76 patients) used in the Calabar study could account for the variance from our study.

In our study, all patients with PAD had arterial wall calcification, 59.0% of them had atheromatous plaques and 52.0% had stenosis. Anas *et al*[11] found luminal stenosis in 29% in about 79 patients with PAD studied in Kano; Northern Nigeria. The atherosclerotic changes that come with ageing bring about narrowing and occlusion or stenosis of coronary and cerebral arteries as well as the aorta and its branches[2]. Furthermore, a Turkish study showed high incidence of PAD in patients over 70 years of age and it was opined that PAD increases with increasing age irrespective of presence or absence of confounding factors such diabetes and hypertension[2].

There was a significant difference between the percentage of those that presented with PAD as the indication for Doppler ultrasound scan and those that had a Doppler ultrasound confirmed diagnosis of PAD (4.6% versus 44.3%, tables 2 and 6). This is possibly due to the fact that, apart from ageing process, some other disease conditions such diabetes, hyperlipidemia, hypertension and obesity are also risk factors for PAD and as such some of them would present as diabetic foot ulcers and leg gangrene and not necessarily intermittent claudication (an established symptom of PAD) as was the case in this study[20]. Patients with these risk factors for PAD should routinely be screened with Doppler scan as this is an established protocol[21].

There was a statistically significantly higher incidence of DVT on the left lower limb (67.7%), than the right (32.3%), a similar, howbeit not significant finding was gotten in a study done by Ikhlas O.S. *et al*[7]. The left sidedness of DVT was first described by Virchow in 1851 and he proposed that this occurrence could be due to compression of left common iliac vein by the right common iliac artery[22]. This was further substantiated by the study done by Thijs *et al*[23] using over 5000 patients with DVT. The proximal lower limb veins; the common femoral vein to the popliteal vein, had the highest detection for DVT (with the highest being in the superficial 27.8% and popliteal 23.1%) as compared to the calf veins, which was 11.1%. Other studies previously done, showed that ultrasound is less sensitive in detecting DVT of the calf veins, as compared to the proximal lower limb veins[24,25,26]. It was also discovered that though the sensitivity of ultrasound detection of calf vein DVT may be low, however these thrombi are less likely to cause pulmonary embolism, as compared to the proximal vein DVTs which are much more likely to cause pulmonary embolism. So, it has been advised that a repeat Doppler scan of a suspected calf vein DVT should be done to access if any thrombus has advanced to the proximal veins, which will then have more likelihood of being detected and intervention carried out to prevent pulmonary embolism[26].

Incompetent sapheno-femoral venous junction and perforating vein are two main causes of varicose veins [27]. These were assessed in the patients who had varicose veins in our study; and it was discovered that incompetent perforating

veins occurred more frequently than incompetent sapheno-femoral venous valves in these patients. This is at variance with a study done in India which showed a significantly higher number of patients with varicose veins having incompetent sapheno-femoral junction[28]. This variation may result from differences in race

REFERENCES

1. Myron A., Paul L. Clinical Doppler Ultrasound. 3rd edition. Edinburgh: Churchill Livingstone; 2014. Pages 94-121.
2. Verim S, Tasci I. Doppler ultrasonography in lower extremity peripheral arterial disease. Arch Turk Soc Cardiol 2013;41 (3):248-255.
3. Rooke TW, Hirsch AT, Misra S, Sidawy AN, Beckman JA, Findeiss LK, et al. 2011 ACCF/AHA Focused Update of the Guideline for the Management of Patients With Peripheral Artery Disease (updating the 2005 guideline): a report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines. J Am Coll Cardiol 2011; 58:2020-45.
4. Hwang JY. Doppler ultrasonography of the lower extremity arteries: anatomy and scanning guidelines. *Ultrasonography.* 2017; 36(2): 111-119.
5. Ibrahim MZ, Igashi JB, Lawal S, Usman B, Mubarak AZ, Suleiman HM. Doppler ultrasonographic evaluation of lower limbs deep-vein thrombosis in a teaching hospital, Northwestern Nigeria. Ann Afr Med 2020;19:8-14.
6. Misauno M A, Sule A Z, Pam S D, Ideke SC, Aching G I. Pattern of duplex doppler ultrasound scans in Jos University Teaching Hospital. Niger J Med.2009;18 (2):158-61.
7. Ikhlas O.S., Ibrahim A.A. Value of Doppler ultrasound in Diagnosis of Clinically suspected Deep vein Thrombosis. IJDMSR 2018; 2(1):01-06.
8. Swaroopa P., Murali K.G. Effectiveness of D-Dimer as a Screening Test for Venous Thromboembolism: An Update. N Am J Med Sci 2014; 6(10): 491-499.
9. Zemaitis MR, Boll JM, Dreyer MA. Peripheral Arterial Disease. [Updated 2023 May 23]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2023 Jan-. Available from: https://www.ncbi.nlm.nih.gov /books/NBK430745/
10. Akpan IS, Enabulele O, Adewole AJ. An overview of peripheral artery disease in the elderly: A study in a tertiary hospital Southern Nigeria. Niger Med J 2020;61:1-5
11. Anas I., Muhammed K.S., Abdulkadir M.T., Kabiru I. Clinical and doppler ultrasound evaluation of peripheral arterial diseases in Kano, North-westwern Nigeria. Niger Postgrad Med J 2015; 22 (4):217-222.
12. Ikpeme A., Akintomide A., Ukweh O., Effanga S. Duplex ultrasound: Indications and findings in a newly created facility at the University of Calabar Teaching Hospital, Calabar. Niger J Clin Pract 2016; 19(3):339-343.
13. Igbinedion B.O., Ogbeide O.U. Utilization pattern of Doppler ultrasound scan at the University of Benin Teaching Hospital. West Afri J Radiol 2015; 22(1): 15-19.
14. Linus U. Nigeria: Meet the Female Bikers Promoting Health Awareness Among Nigerian Women. https://allafrica.com/ stories/20182200689.html. Published in 2018
15. Verdonk P, Benschop YWM, De Haes, HCJM *et al.* From gender bias to gender awareness in medical education. Adv in Health Sci Educ 2009;14:135.
16. Tiwari A, Cheng K, Button M, Myint F, Hamilton G. Differential Diagnosis, Investigation, and Current Treatment of Lower Limb Lymphedema. Arch Surg. 2003; 138 (2):152-161.

17. Li L, Zhen J, Huang L, Zhou J, Yao L, Xu L, *et al.* The risk factors for deep venous thrombosis in critically ill older adult patients: a subgroup analysis of a prospective, multicenter, observational study. *BMC Geriatr* **22**, 977 (2022). https://doi.org/10.1186/s12877-022-03599-y.
18. Miller AP, Huff CM, Roubin GS. Vascular disease in the older adult. J Geriatr Cardiol. 2016; 13(9):727-732.
19. Savji N, Rockman C B, Skolnick A H, Guo Y, Adelman M A, Riles T, *et al.* Association between advanced age and vascular disease in different arterial territories: a population database of over 3.6 million subjects. J Am Coll Cardiol, 61 (2013), pp. 1736-1743.
20. Mary MM, Jack MG, Luigi F, Lu T, Kiang L, Yihua L *et al.* Asymptomatic Peripheral Arterial Disease Is Associated With More Adverse Lower Extremity Characteristics Than Intermittent Claudication. J. Am. Heart Assoc 2008; 117 (19): 2484 – 2491.
21. Hiremath R, Gowda. G, Ibrahim J, Reddy H T, Chodiboina H, *et al.* Comparison of the severity of lower extremity arterial disease in smokers and patients with diabetes using a novel duplex Doppler scoring system. Ultrasonography 2017; 36:270-277.
22. Virchow R. Ueber die Erweiterung kleinerer Gefa¨fse. Arch Pathol Anat Physiol Klin Med 1851; 3: 427–62.
23. Thijs W, Rabe KF, Rosendaal FR, Middeldorp S. Predominance of left-sided deep vein thrombosis and body weight. J Thromb Haemost 2010; 8: 2083–4.
24. Jeanette M, Nicolaides AN, Walker CJ, O'Connell JD. Value of Doppler ultrasound in diagnosis of clinically suspected deep vein thrombosis. BMJ. 1975; 4: 552-554.
25. Goodacre S, Sampson F, Thomas S, Van Beek E, Sutton A. Systematic review and meta-analysis of the diagnostic accuracy of ultrasonography for deep vein thrombosis. BMC Med Imaging. 2005 Oct 3; 5:6.
26. National Clinical Guideline Centre (UK). Diagnosis of Deep Vein Thrombosis. Venous Thromboembolic Diseases: The Management of Venous Thromboembolic Diseases and the Role of Thrombophilia Testing (Internet). London: Royal College of Physicians (UK); 2012; 144:5.
27. Francis F, Ahmed A. Varicose veins https://radiopaedia.org/article/varicose-veins?lang=us. Last reviewed 2017.
28. Irodi A, Keshava SN, Agarwal S, Korah IP, Sadhu D. Ultrasound Doppler Evaluation of the Pattern of Involvement Varicose Vein in Indian Patients. Indian J Surg. 2011; 73(2): 125-130.

How to Cite: This article should be cited as: Ehigiamusoe FO, Emilomon JO. Spectrum of Findings in Lower Limb Doppler Ultrasonography in UBTH, Benin City Afr. J. Trop. Med. & Biomed. Res. 2023; 6(2): 35-44. *https://dx.doi.org/10.4314/ajtmbr.v6i2.4*