

Pattern of Duplex Doppler Ultra Sound Scans in Jos University Teaching Hospital

*Misauno M A FWACS, *Sule A Z FWACS **Pam S D, **Ideke S C, ***Aching G I

*Departments of Surgery and Radiology, **Jos University Teaching Hospital.

****Department of Medicine, Benue State University

Abstract

Introduction: Doppler ultrasound scan is a non invasive diagnostic tool used in the evaluation of vascular and peri-vascular lesions. It is gaining a wider acceptance over other methods of vascular evaluation which are expensive and invasive. We aimed at evaluating the indications and findings of duplex doppler ultrasound scans performed in this centre.

Methodology: This was a retrospective study of all consecutive patients that had doppler ultrasound scans from January 2000 to December 2004

Results: One Hundred and sixty five (165) Doppler ultra sound scans were performed on 115 patients. Thirty nine patients had a double scan while 19 had repeated scans. The study population was aged between 2-90 years with a mean age of 44.5+/- 17.5 years. There were 86(52.1%) males and 79(47.9%) females giving a male to female ratio of 1:1.

67(41%) of the doppler scans were for deep vein thrombosis while peripheral vascular disease and vascular aneurysm accounted for 24 (14.5%) and 23(13.9%) respectively, see. Table 1

Reduction in vascular blood flow was the most common doppler finding seen in 34(20.6%) patients followed by visible thrombi in 14(8.5%) patients

Conclusion: Deep vein thrombosis is the most common indication for doppler ultrasound scan in our practice.

Keywords: Duplex, doppler, vascular, diagnostic, ultrasound.

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Introduction

The "Doppler Effect" named after Austrian physicist and mathematician Christian Johann Doppler in 1842, refers to the apparent variation in the frequency of an emitted wave as the source of the wave approaches or moves away relative to an observer^{1,2}

This Doppler Effect has found uses in many spheres of human endeavours including astronomy, physics and medicine. In medicine, it is used for non-invasive monitoring and evaluation of blood vessels and pathologies around these blood vessels. In this setting, the red blood cells serve as mobile reflectors of sound waves while the transducer represents the stationary observer.

Different types of doppler ultra sound scans are available, these include:

- Continuous wave doppler in which the ultra sound waves are emitted in a continuous fashion and is suitable for measuring high velocity flow rates, but it can not evaluate accurately deep seated vessels
- Pulsed wave doppler where there is a pulsatile release of the ultra sound waves with good depth resolution. Its disadvantage is that it cannot measure high velocity flow rate.
- Colour doppler ultra sound scan: - This is an additional development to the other two mentioned and it utilizes colour codes to depict flow; with flow towards the probe depicted as red, while flow away from the probe is depicted as blue. Turbulent flow as in A-V fistula appears as a mixture of red and blue.
- Duplex doppler ultra sound scan: - This utilizes a combination of B-mode scan, and doppler ultra sound scan.^{3,4} This combination enables us to localize accurately the blood vessels with the B-mode while the velocity is measured with the doppler component. The machine used for this study has facilities for a duplex scan.

Vascular pathologies can be evaluated using doppler ultra sonography, venography, scintigraphy, impedance plethysmography, computerized tomographic angiography, magnetic resonance angiography, and recently digital subtraction angiography. Venography has enjoyed a pride of place in the diagnosis of deep venous thrombosis but computerized impedance plethysmography and doppler ultra sound scan represent new developments in non-invasive diagnosis

of deep vein thrombosis of the lower limbs giving a sensitivity of 91 and 100% respectively.⁵⁻¹¹

Several studies have been conducted comparing doppler ultrasound scan and other modalities of investigations with doppler being preferred because it is cheap and non invasive.⁴⁻⁹

Whereas magnetic resonance angiography, CT angiography, digital subtraction angiography, plethysmography and venography are not readily available, and where available are expensive, doppler ultra sound scan is a suitable alternative modality for the noninvasive evaluation of vascular and peri-vascular pathologies.¹²⁻¹⁸ This study therefore aims at evaluating the indications and findings of duplex doppler ultra sound scans in Jos University Teaching Hospital, Jos, Nigeria.

Methodology

This was a retrospective analysis of all consecutive duplex doppler ultra sound scans performed in the Radiology department of the Jos University Teaching Hospital between January 2000 and December 2004. This hospital is a tertiary health care center located in the middle belt of Nigeria. These Doppler ultra sound scans were performed by three different sonographers over the study period maintaining standard Doppler scanning protocol as it pertains to the different body regions being scanned using an ultra mark-9 HDI ultra sound machine with duplex facility manufactured by Advanced Technology Laboratories; Bothell WA 98021 USA1993,. The scans were performed using a 7-10 MHz curvilinear probe.

Whereas neck and upper limb doppler scans are performed with the patient supine with neck extended on a pillow and arms abducted and externally rotated to expose the vessels, abdominal scans are conducted with the patient supine and exposure is from nipple to mid-thighs. Lower limb doppler assessment was done with the patient in the dorsal position behind a screen with exposure of both lower limbs up to the umbilicus. The limb to be assessed is flexed at the hip and knee and slightly abducted so that its heel is supported by the contra lateral heel. This position exposes the femoral vessels up to the adductor hiatus. Assessing the popliteal and posterior tibial vessels requires that the patient lies prone while the anterior tibial and dorsalis pedis vessels are scanned with the patient prone. Ultrasound gel is applied and the scan commences from the groin crease using transverse, longitudinal and oblique planes. Reduced velocity, decreased compressibility, absent wall to wall filling of the blood column, visible intra luminal thrombi and inadequate flow augmentation on calf compression all suggest deep vein thrombosis. Vascular dilatation more than 50% of

normal diameter, turbulent flow, intra or extra luminal thrombi are in keeping with aneurysms, while hyperechoic thickened vascular walls with velocity change suggest peripheral vascular disease.

Hospital records of the patients were obtained and data extracted included the age of the patient, sex, indication for doppler, clinical diagnosis and doppler ultrasound findings. Patients whose data entries were incomplete were excluded from the study. Information obtained was analysed for simple means and percentages using Epi-info version 3.2.2

Results

One Hundred and sixty five doppler ultra sound scans were performed during the study period on 115 patients. Thirty nine patients had a double scan while 19 had repeated scans. The age range of the study population was 2-90 years with a mean age of 44.5+/- 17.5 years. There were 86(52.1%) males and 79(47.9%) females giving a male to female ratio of 1:1.

Sixty seven scans (41%) were for deep vein thrombosis while peripheral vascular disease and vascular aneurysm accounted for 24 (14.5%) and 23(13.9%) respectively, see. (Table I)

Non-vascular pathologies were the reason for doppler scans in 12(7.2%) patients while 69(41.1%) patients had normal doppler findings. Reduction in vascular blood flow was the most common doppler finding seen in 34(20.6%) patients followed by visible thrombi in 14(8.5%) patients, see (Table II)

Table I. Indication for duplex ultra sound scan

Clinical diagnosis	No	Percentage
Arterial thrombosis	10	(6%)
Deep vein thrombosis	67	(41%)
Vascular aneurysms	23	(19%)
Gangrene	5	(3%)
Peripheral vascular diseases	26	(15.7%)
Renal artery stenosis	4	2.4%)
Goitre	6	(3.6%)
Diabetic foot disease	7	(4.2%)
Testicular torsion	3	(1.8%)
Varicocele	4	(2.4%)
Varicose Veins	3	(1.8%)
Venous ulcer	1	(0.6%)
Cystic hygroma	1	(0.6%)
Cold abscess	1	(0.6%)
Dermoid cyst	1	(0.6%)
Soft tissue sarcoma of thigh	1	(0.6%)
Sternomastoid tumour	1	(0.6%)
Caecal tumour	1	(0.6%)
TOTAL	165	100%

Table II: Duplex Ultrasound Scan Findings

ULTRA SOUND FINDINGS	NO	PERCENTAGE
Visible thrombi	20	(12.1%)
Reduced flow in vessels	34	(20.6%)
Aneurysmal dilatation	10	(6.1%)
Calcifications	9	(5.5%)
Incompressibility of vessel	14	(8.5%)
Velocity difference	4	(2.4%)
Turbulence	4	(2.4%)
Absent wall to wall filling of vessel	3	(1.8%)
Absent flow augmentation on calf compression	2	(1.2%)
Normal	1	(0.6%)
TOTAL	165	100%

Discussion

The most common indication for duplex doppler scanning in this study was deep vein thrombosis; accounting for 67 cases (41%). This figure appears high when compared to the findings of Pulliam et al, in a duplex scanning of 442 patients with clinical suspicion of DVT; they found a DVT rate of 14.47%.¹⁹ The disparity in these results may not be unconnected to the high sample size in their study and the fact that they concentrated on patients with clinical suspicion of lower limb DVT.

The use of reduced vascular flow, intraluminal echogenicity and incompressibility of blood vessels as sonographic criteria for diagnosis of DVT in this study are completely in agreement with Mossurakis et al who found them very useful in sonographic diagnosis of DVT.²⁰ These findings suggest that the DVT rate in our environment may not be as low as we think, and increased utilization of duplex scanning facilities where available may reveal the true incidence in our environment.

Peripheral vascular disease which was through not to be common in Africans accounted for 26 (15.7%) of

diagnosis in this study. This finding is in agreement with those of Kumar et al in black south Africans, where he found a peripheral vascular disease rate of up to 29% implying that the paucity of this diagnostic facility is probably responsible for the under diagnosis. This assertion is further strengthened by Yinusa et al where he lamented the unavailability of doppler ultrasonography in their paper titled problems of amputation in a developing country.²¹

Vascular aneurysm was the 3rd most common diagnosis in this series accounting for 13.9% of the cases. This is in complete disagreement with Akinola's report of an incidental ultrasound diagnosis of abdominal aortic aneurysm in a 22year old Nigerian.²² This report tends to suggest that abdominal aortic aneurysms are rare in our practice but we believe that increased utilization of duplex scanning facility is likely to reveal the true incidence of this pathology.

Twelve patients (7.3%) had duplex scans to aid in the diagnosis of non vascular pathologies like malignant goitre, caecal tumour, cystic hygromata, cold abscesses in the neck, extremity soft tissue sarcomas and dermoid cyst. One thing peculiar to these swellings is that they occur in the neighborhood of major vessels and the location and involvement of these vessels is important for a successful planned surgery. The increasing use of duplex scanning for the evaluation of these pathologies in this study may be because other cross-sectional imaging techniques like CT scan and MRI were lacking at the time of this study.

In conclusion, duplex doppler scanning is an emerging, cheap and non invasive diagnostic modality that should be embraced in our environment for the evaluation of vascular and peri-vascular pathologies.

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