

Lower extremities Duplex-Doppler ultrasonography for the detection of suspected deep venous thrombosis: A preliminary report from Sokoto



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ABSTRACT

Background: There is a paucity of reports on the deep vein thrombosis in our environment, which creates the impression that the condition is uncommon. **Aims and Objectives:** The aim of this study is to report the account of our hospital in management of patients with Suspected Lower Extremities Deep Venous Thrombosis using Duplex-Doppler Ultrasonography. **Materials and Methods:** Between January to December 2014 forty six in patients with suspicion of DVT were evaluated prospectively. All patients presented with symptoms of single or bilateral disease, and a high probability of the disease. Two trained radiologists performed all duplex scan examinations. The patients were scanned using Mindray DC-3/DC-3T Diagnostic ultrasound scanner (Mindray Bio- Medical Electronics Co., LTD) linear (7-12MHz) transducers was used. **Results:** A total of 46 patients had duplex-Doppler scan examination was carried out between January-December 2014. There were 30(65.2%) males and 16(38.8%) females subjects recruited for the study. The mean age was $48.9 \pm SD17.3$ with range of 18-85 years. A total of 21 patients (45.6%) were found to have deep vein thrombosis (DVTs) on duplex-Doppler examination. Proximal DVTs was seen in 6(12.9%) and 14(30.3%) for right and left lower limbs respectively. Distal DVTs was seen in 1(2.2%) in the right lower limb and 25(54.4%) show normal findings bilaterally. Diffused DVTs was seen in 2(4.3%) patients involving external, through popliteal veins on the right lower limb. In 3(6.5%) of the patients only the common femoral, superficial femoral and popliteal shows diffuse DVTs. **Conclusion:** With availability of Doppler ultrasound in our environment the diagnosis of DVT is now easier. Duplex scanning techniques are faster, safer, and less expensive. Because of its noninvasive nature, venous duplex is repeatable, allowing for continued follow up after the diagnosis.

Key words: Lower extremities, Duplex-doppler, Ultrasonography

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INTRODUCTION

Acute or subacute deep vein thrombosis (DVT) usually, but not exclusively, occurs in the legs with an estimated incidence of 1:1000 per year.¹ Venous thrombosis (VT) is the third most common cardiovascular disease after myocardial infarction and stroke.² Approximately 2 million patients are diagnosed with a deep venous thrombosis annually in the United States with approximately 600,000

hospitalizations and another 200,000 deaths resulting from pulmonary embolism.³⁻⁵ DVT typically starts distally below the knee but can extend proximally above the knee and potentially result in life-threatening pulmonary embolism.⁶ Pulmonary embolism can occur in 50%–60% of patients with untreated DVT, with an associated mortality rate of 25%–30%.⁵ Mortality associated with venous thromboembolism is more commonly seen in patients who present with pulmonary embolism or

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have advanced age, cancer, or underlying cardiovascular disease.⁷

Different approaches to the diagnosis of deep vein thrombosis have been validated in several studies.^{3-4,8-9} There are few reports on DVT in the African literature and have mainly been on postoperative patients.¹⁰ There is a paucity of reports on the condition in our environment, which creates the impression that the condition is uncommon and in most cases the physician use their clinical assessment to make the diagnosis. However with availability of Doppler ultrasound in our environment the diagnosis of DVT is now easier. Duplex scanning techniques are faster, safer, and less expensive. Because of its noninvasive nature, venous duplex is repeatable, allowing for continued follow up after the diagnosis. In addition duplex imaging can assess the echogenic characteristic of the thrombus and its degree of adherence to the vein wall.¹¹ The clinical presentations of deep vein thrombosis (DVT) in our environment are usually leg pain, swelling and tenderness of the limb. A significant number of these patients have sign and symptoms of venous insufficiency prior presentation which sometime make it difficult to differentiate from recurrent DVT. Deep vein thrombosis is a frequent clinical problem that can result in substantial mortality due to pulmonary embolism.¹²

MATERIALS AND METHODS

Between Januarys to December 2014 forty six in patients with clinical suspicion of DVT were evaluated prospectively. All patients presented with signs and symptoms of single or bilateral disease, and a high probability of the disease. This study was performed at a single-center, urban, University-affiliated teaching Hospital.

Two trained radiologists performed all duplex scan examinations. The patients were scanned using Mindray DC-3/DC-3T Diagnostic ultrasound scanner (Mindray Bio- Medical Electronics Co., LTD) linearmultifrequencial (7-12 MHz) transducers for the limb scan. Venous segments evaluated were external iliac vein, common femoral, superficial femoral, popliteal anterior and posterior tibial veins. Duplex scan examination of the affected limb was performed and included gray scale, color Doppler, and spectral evaluation. Direct hypoechoic thrombus B-mode identification, and absence of spontaneous or maneuver-induced venous flow were also documented. We excluded patients those with known chronic DVT, patients on anticoagulation prior to ultrasound imaging, patients with plaster of Paris or above-knee amputation, or previously identified acute DVT on comprehensive imaging. There was no distinction

made between patients suspected of having a proximal lower extremity deep venous thrombosis or an isolated calf deep venous thrombosis for enrollment purposes. Any patient with a suspected lower extremity deep venous thrombosis was eligible. There were no exclusions made according to sex, ethnicity or weight.

Data collected for this study were maintained in a Microsoft Excel worksheet, with subsequent analysis using SPSS (Version 17.0).

RESULTS

A total of 46 patients had duplex-Doppler scan examination from the Department of Radiology Usmanu Danfodiyo University Teaching Hospital Sokoto between January-December 2014. There were 30 (65.2%) males and 16 (38.8%) females subjects recruited for the study. The mean age was $48.9 \pm SD 17.3$ with range of 18-85 years. A total of 21 patients (45.6%) were found to have deep vein thrombosis (DVTs) on duplex-Doppler examination. Proximal DVTs was seen in 6 (12.9%) and 14 (30.3%) for right and left lower limbs respectively. Distal DVTs was seen in 1 (2.2%) in the right lower limb and 25 (54.4%) show normal findings bilaterally. Diffused DVTs was seen in 2 (4.3%) patients involving external, common femoral, superficial femoral and popliteal veins on the right lower limb. In 3 (6.5%) of the patients only the common femoral, superficial femoral and popliteal shows diffuse DVTs. The most common indication was lower limb swelling and pain accounting for 18 (39.2%), while suspected DVT was 11 (23.9%). Table 1 shows ultrasound findings in all the patients with their frequency and percentages Figure 1. A Bar chart showing age distribution Figure 2a. B-Mode Ultrasound showing a thrombus in femoral vien. Figure 2b. Duplex-Doppler scan showing absence of Doppler signals in the femoral vein due to thrombus.

Table 1: Ultrasound findings in all the patients with their frequency and percentages

Diagnosis	Frequency	Percentage
Left Normal	17	37.0
Right CFV/SFV/PV DVTs	2	4.3
Right SFV/PV DVTs	2	4.3
Right PV DVTs	2	4.3
Right ATV DVTs	1	2.2
Left EIV/CFV/SFV/PV DVTs	3	6.5
Left PTV DVTs	1	2.2
Left CFV/SFV DVTs	3	6.5
Left CFV/SFV/PV DVTs	2	4.3
Left CFV DVTs	2	4.3
Left SFV	2	4.3
Left PV DVTs	1	2.2
Right Normal	8	17.4
Total	46	100.0

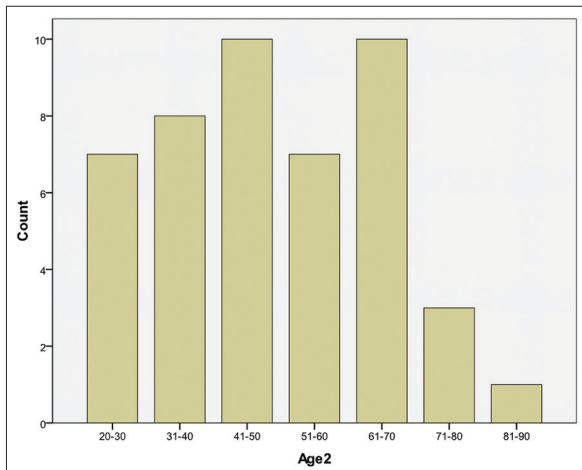


Figure 1: A Bar chart showing age distribution

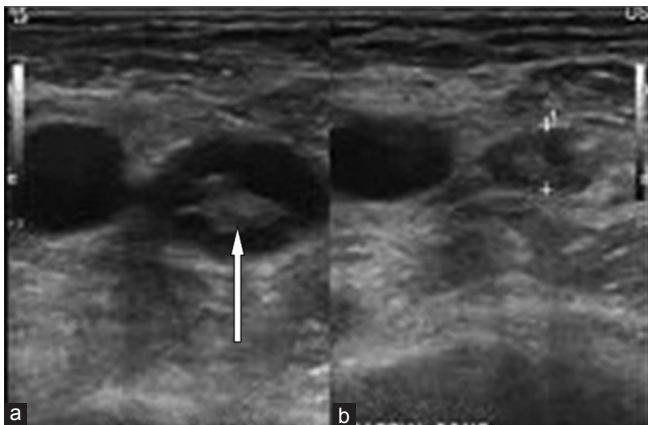


Figure 2: (a) B-Mode Ultrasound showing a thrombus in femoral vein. (b) Duplex-Doppler scan showing absence of Doppler signals in the femoral vein due to thrombus

DISCUSSION

Deep vein thrombosis is a common but difficult to detect illness that can be fatal if not treated well. Approximately 2 million patients are diagnosed with a deep venous thrombosis annually in the United States with approximately 600,000 hospitalizations and another 200,000 deaths resulting from pulmonary embolism.¹³⁻¹⁵ Venous thrombosis is more common in Europe and USA than in Asia and Africa. Incidence of DVT is reported as 20–35% in western countries 9.6% in Sudan and 2.2% in Malaysia.¹⁶⁻¹⁷

There is paucity of data in our environment concerning Duplex-Doppler scan diagnosis of DVT.

Previous studies have reported abnormal Duplex-Doppler scan (DUS) findings in only 3.6% of patients without signs or symptoms suggestive of DVT.¹⁸ In the present study, only patients with signs or symptoms of DVT in the lower limbs were examined. DVT was confirmed by DUS in 45.6% of the cases, demonstrating that symptoms

and signs suggestive of DVT are very common and can be caused by other clinical conditions. The patient ages from previous studies had already demonstrated that DVT rates increase with age and that 1/100 of individuals > 70 years old are affected every year.¹⁹⁻²¹ The peak age groups in our patients was seen between 40-50 and 61-70 years.

In the past Duplex-Doppler ultrasound and qualified radiologists were not available in our environment as such making diagnosis of DVT was mainly by clinical assessment and venography. Because none of the available imaging modalities have ideal test characteristics, hence the diagnosis of deep venous thrombosis remains challenging.^{14,22-23} Contrast venography exposes the patient to radiation and intravenous contrast material, has special technical requirements that limit its availability, and has associated morbidity.^{14,24-26} Therefore, duplex ultrasonography with compression ultrasonography, as well as color and flow Doppler ultrasonography of the lower extremity for detecting deep venous thrombosis is recommended because it has sensitivity of 91% to 96% and a specificity of 98% to 100%.^{8,26} In addition because of its non-invasiveness venous imaging is repeatable. It can also assess the echogenic characteristic of the thrombus at its degree of adherence to the vein wall.¹¹ This test also provides important information regarding valves motion and reflux in superficial and deep veins.²⁷⁻²⁸

Magnetic resonance venography (MRV) is another noninvasive alternative to contrast x-ray venography that shares many of the clinical advantages of Ultrasound, such as not exposing the patient to ionizing radiation or iodinated contrast media.²⁹⁻³² MRV has been shown to successfully diagnose DVT using any variety of pulse sequences or techniques.³⁰⁻³² Despite the wide variety of techniques, however, a recent meta-analysis found MRV to have both high sensitivity (range, 87.5%–94.5%; pooled sensitivity, 92%) and specificity (range, 92.6%–96.5%; pooled sensitivity, 95%).³¹ However because of non-availability of higher tesla Magnetic resonance imaging machines in our environment in addition to high cost of the examination, MRV was not carried out on our patients.

Computed Tomography Venography (CTV) can also be used to diagnose DVT.^{31,33-34} However, there are the same clinical concerns about its use as there are with contrast x-ray venography, namely, patient exposure to ionizing radiation and iodinated contrast media. In patients who have a suspected pulmonary embolism, a recent meta-analysis found CTV to have high sensitivity (range, 71%–100%; pooled sensitivity, 95.9%) and high specificity (range, 93%–100%; pooled specificity, 95.2%) comparable to that of Ultrasound for diagnosing proximal DVT.³² However CTV may be considered a reasonable alternative to MRV for pelvic DVT or when Ultrasound is non-diagnostic.

It is clinically important to determine the location and extent of DVT.^{5,33} DVT that is limited to the infrapopliteal calf veins (i.e., below-the-knee or distal DVT) often resolves spontaneously and is rarely associated with pulmonary embolism or other adverse outcomes.^{5,35-36} Above-the-knee or proximal DVT, on the other hand, is strongly associated with the risk of pulmonary embolism. Majority of our patient had above knee DVT. Classically, a patient with symptomatic lower-extremity DVT presents with either local pain or tenderness or with edema and swelling of the lower extremity. However, approximately one-third of patients with DVT do not have any symptoms.¹ Often, symptoms are not apparent until there is involvement above the knee.⁵ The most common clinical indication in our patients was lower limb swelling and pain accounting for 18(39.2%).

All the patients in this study did not present with signs and symptoms of pulmonary embolism. However pulmonary embolism can occur in 50%–60% of patients with untreated DVT, with an associated mortality rate of 25%–30%.⁵⁻⁶ Mortality associated with venous thromboembolism is more commonly seen in patients who present with pulmonary embolism or have advanced age, cancer, or underlying cardiovascular disease.⁷ There is always the need to exclude alternative conditions, such as an intact or ruptured Baker's cyst, cellulitis, lymph edema, chronic venous disease, and various musculoskeletal disorders that can clinically mimic DVT during the ultrasound scan. Ultrasound can also be used to tailor the duration of anticoagulant therapy.³⁷ The use of Ultrasound in evaluating patients with DVT has limitations especially the level of inguinal and knee regions.

CONCLUSION

Although ultrasound is highly sensitive and specific for evaluating patients with DVT especially proximally, its sensitive is less for evaluating distal DVT. Majority of our patient had above knee DVT with incidence of about 45.6%. With availability of Doppler ultrasound in our environment the diagnosis of DVT is now easier. Duplex scanning techniques are faster, safer, and less expensive.

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Authors Contribution:

SMM - Concept and design of the study, reviewed the literature, manuscript preparation and critical revision of the manuscript; **SBK** - Concept, collected data and review of literature and helped in preparing first draft of manuscript; **SAA** - Conceptualized study, literature search, statistically analyzed and interpreted, prepared first draft of manuscript and critical revision of the manuscript.

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