

Value of Color Doppler US in Evaluation of Deep Vein Thrombosis of Lower Limb

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Abstract

One hundred forty patients attended the department of radiology in AL-Salam General Hospital were used in this study to assess the valuability of color Doppler US in evaluation of D.V.T in lower limb. The sensitivity of color Doppler US in diagnosing the DVT was 100% there was no great difference in sex distribution, or site affected. It was found that secondary DVT (i.e. with predisposing factor). Commoner than primary or idiopathic DVT.

Keywords: Color doppler; Sex distribution; Radiology; Patients

- Source evaluation for known suspected pulmonary embolism.
- Chronic venous insufficiency.

Introduction

Deep Vein Thrombosis (DVT) is a major medical problem of lower limb, and a common clinical disorder that can lead to fatal pulmonary emboli and post phlebotic syndrome [1]. Contrast venography is the gold standard for diagnosis of deep vein Thrombosis, however this technique is invasive and requires the use of potentially hazardous contrast agent [2]. So B-Mode compression sonography and color Doppler imaging is the method of choice in detection of deep vein thrombosis of lower extremity, it is readily available, repeatable at any time, and is the least stressing for the patient. So intravenous phlebography has lost its importance and is only indicated in rare situation [3].

The veins of lower extremity include superficial and deep vessels as well as communicating veins in the calf. The deep veins include the common superficial and deep femoral veins; the popliteal vein; the anterior tibial, peroneal and posterior tibial veins of the calf. The superficial veins include the greater and lesser saphenous veins. The superficial and deep venous systems are connected by communicating veins. The deep veins follow the course of the femoral artery and its branches. The anatomic relationship of artery to the accompanying vein changes as the vessels pass distally [4]. Vein wall is thin muscular structure composed of three layers they are: Intima, Media and Adventitia valves are formed by in folding of the intima and these are unidirectional valves allowing blood to return to the heart. Adjacent to the valve is a small out pouching of the vein wall called valve sinus. Muscular contraction is primarily responsible for trans- venous flow with the valves closing with reduction in venous pressure preventing reversal of blood flow. Valves are found in deep, superficial and muscular (venous sinuses) venous system deep veins course in close proximity with their corresponding artery. Singular in proximal portion of the extremity and paired distally superficial veins do not have any associated artery located near the skin surface and communicate with deep veins system via communicating veins. (Venous now one way from superficial to deep system) [5].

Indications for venous Doppler Examination of the leg are:

- Clinical suspicion of deep vein thrombosis.

Material and Method

Using (kretz) color doppler device with 7.5 MHz probe, we examined (140) patients who referred to the department of radiology in Al-Salam general hospital with provisional diagnosis of deep vein thrombosis all patient underwent color Doppler US assessment. The examination is usually begin with patient in supine position with hip is slightly abducted and externally rotated to allow access to the inner aspect of the thigh, the common femoral, superficial femoral and greater saphenous veins are examined with a patient in supine position, for the evaluation of the popliteal and calf veins the patient is placed in lateral decubitus or prone position, elevation of head to 10°-15° may aid in the examination by distending the veins of interest, for checking of valves whether they are competent or not we examine the patient in standing position [4].

The veins were evaluated for:

1. Vein compressibility.
2. Changes of veins with respiration.
3. Direction of flow.
4. Presence or absences of collateral circulation.
5. Augmentation test (flow accentuation when the calf is squeezed).
6. Presence or absence of thrombus any detectable thrombus was localized and two dimensions are taken.
7. Effect of Valsalva maneuver on the veins.
8. Compatibility of valves.

Diagnostic criteria of deep vein thrombosis

Visualization of thrombus: The earliest manifestation of deep vein thrombosis

Detectable by US is the finding of small area of thrombus in valve recess. Color Doppler imaging may show flow disturbance associated with these early changes. The limitation of this criteria is that not all

thrombus sufficiently echogenic to be readily identified by imaging alone, also artifact specially in small vessels may give rise to intramural echoes that suggest the presence of thrombus. With Color Doppler imaging information related to flow over coming this problem.

Vein compressibility: Normal veins have thin walls and are easily compressed; lack of compressibility is an important imaging criterion for the presence of intraluminal thrombus. Venous compression should be applied while transverse image of the vein is obtained to prevent the possibility of transducer slipping on the vein. The ability to compress the vein completely in general regard as reliable indicator of the absence of thrombus.

Vein size: The presence of Thrombus typically enlarge the vein diameter making the vein appear larger than the accompanying artery.

Respiratory changes: Larger veins increased noticeably in diameter with deep inspiration and the Valsalva maneuver, and diminished in diameter with expiration as abdominal pressure reduced and flow resume. Absence of normal response may indicate occlusion of vessels proximal to the site being examined.

Results

Data collected in this study were analyzed and showed that the Frequency of deep vein thrombosis was (38.5%). There were 80 female patients (57.1%) and 60 male patients (42.8%) aged between 22-65 years, all of them under went complete assessment of venous system of lower extremities which include examination of all segments of deep veins. Tables 1-8 showed the distribution of deep vein thrombosis according to age, sex, site, and size of thrombus, segments of veins involved and accidental finding. On the basis of the clinical decision to treat patients the sensitivity of color Doppler US in this study was 100%, we can't find the specificity because we don't follow negative patients.

Doppler finding	No. of patients	%
Normal veins	55	39.2
D.V.T	54	38.5
Accidental finding	31	22.1

Table 1: Percentage of doppler findings.

Age of patient in years	No.	%
20-30	20	37.03
31-40	13	24.07
41-50	9	16.6
51-60	6	11.1
61-70	6	11.1

Table 2: Distribution of DVT in the limb according to age of patient.

Sex of patients	No.	%
Female	27	50

Male	27	50
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Table 3: Distribution of DVT according to sex.

Limb affected	Site	%
Right	20	37.03
Left	33	61.1
Bilateral	1	1.8

Table 4: Distribution of DVT according to site.

Vein involved in DVT	No. of patients	%
Common femoral vein	23	48.5
Popliteal vein	12	22.2
Superficial femoral	4	7.4
External iliac vein	6	11.1
Greater saphenous vein	5	9.2

Table 5: Distribution of thrombus in the segments of veins.

Doppler finding	No. of patients	%
Baker cyst	7	22.5
Atherosclerosis	5	16.2
Haemangioma	3	9.6
Haematoma	2	6.4
Varicosity of leg veins	10	32.2
Oedema of subcutaneous tissue	4	12.9

Table 6: Distribution of accidental pathology.

Type of DVT	No.	%
Idiopathic	14	25.8
secondary	40	74.7

Table 7: Distribution of DVT according to predisposing factors.

Size of thrombus	Average measurement	No. of patients	%
Large	45 x 35 mm	13	24.07
Medium	17 x 6 mm	26	48.14
Relatively small	8 x 4 mm	10	18.5

Table 8: Distribution of D.V.T. according to the size of thrombus.

Discussion

In this study an attempt was made to evaluate patients with clinically suspected deep vein thrombosis which was previously

confirmed by instrumental procedure, in this study confirmed by color Doppler US. In fact about 62% of patient with clinically suspected deep vein thrombosis are shown to be negative on color Doppler US (55 patients out of 140). In a study done by Salcuni [6] found that about 70% of patients with clinically suspected deep vein thrombosis are shown to be negative on instrumental investigation and he consider phlebography is still the gold standard in the diagnosis of peripheral deep vein thrombosis. In other study by Armstrong [7] found that US is normal in 77% of a total of 256 patients were referred from emergency department the Doppler US were interpreted as normal in 198 patients (77%) positive finding were discovered in 58 patients (23%) with deep vein thrombosis accounting for 43 patients (17%). In a study done by Lennox [8] on 200 patients he found that 46 patients (23%) had acute deep vein thrombosis on Doppler US, of these cases 28 patients (61%) had proximal D.V.T and 18 patients (39%) were confined to calf. In our study 38 patients out of 54 patients (70.3%) had proximal deep vein thrombosis, 16 patients (29.6%) had D.V.T confined to the calf. In a study done by Labro [9] on 5250 patients age range from (22-93 years) were referred for clinical suspicion of deep vein thrombosis and underwent examination with color Doppler US, all superficial and deep veins of calf imaged, deep vein thrombosis was detected in 14% of patients. Isolated calf deep vein thrombosis was detected in (282) limbs of 251 patients (4.8%). No significant difference was noted for sex, 114 men vs. 137 women or limb preference 145 left limbs vs. 137 right limbs.

In our study also no sex difference 27 male and 27 female age range 22-67years, 33 patients out of 54 patients had DVT in left limb and 20 patients had in right limb and only one had bilateral deep vein thrombosis. Regarding the distribution of thrombi it was found in our study that (42.5%) of thrombi found in common femoral vein, (22.2%) in the popliteal vein, 7.4% in the superficial femoral vein 11.1% in the external vein, and 9.5% in great saphenous vein. In a study done by Daniel [10] on (2704) lower extremity all of them studied with color Doppler US, acute deep vein thrombosis was identified in 269 limb (9.9%) of these 269 cases deep vein thrombosis was isolated to superficial femoral vein in 60 patients (22.3%), the remaining 209 cases (77.7%) showed thrombus extend to common femoral vein or popliteal vein or both. Regarding the predisposing factor in our study we found that 40 patients out of 54 patients had a risk or predisposing factor i.e., secondary deep vein thrombosis, in 14 patients the deep vein thrombosis was considered idiopathic the most frequent risk factors were previous surgery, trauma, immobilization after fracture, pregnancy, post labor and atherosclerotic vascular disease [11]. In a study done by Balbarini [12] 146 patients (84 males and 62 females) in 130 patients a risk factor or predisposing condition was identified about (89%) in 16 patients deep vein thrombosis was consider idiopathic the most frequent risk factors were previous surgery, immobilization, trauma and tumors. Joseph [13] found that in deep vein thrombosis of femoropopliteal system loss of compressibility of a thrombus filled vein had emerged as the single most useful diagnostic criterion. There are certain Doppler flow criteria that can support the making of positive diagnosis and these are include loss of respiratory passivity and loss of flow accentuation when the calf is squeezed. In our study also we found that all veins which are closed with thrombus whether complete or partial obstruction have either complete or partial loss of compressibility respectively, also we found Augmentation test (flow accentuation) was negative in all thrombosed veins, regarding phasicity of venous flow with respiration is also lost. In textbook of Christopher [4] he found 19 patients of 60 patients evaluated were considered to have sufficient evidence of deep vein thrombosis to

warrant treatment with anticoagulant, although only 5 had contrast venographic confirmation of the abnormality, all 19 patients treated for deep vein thrombosis have positive color Doppler US study. Of the 19 cases in which deep vein thrombosis was identified (78.9%) involve superficial femoral vein, (63.2%) involve the popliteal vein and involve superficial femoral vein, (63.2%) involve the popliteal vein and (26.3%) extend into common femoral vein and no thrombus was found in the iliac vein. On the basis of the clinical decision to treat patients the sensitivity and specificity of color Doppler US in this study were, 100% and 97.6% respectively. There was one false positive and 40 true negative.

Foley et al. [14] had reported the result of color Doppler US in study of 475 patients with suspected lower venous thrombosis, occlusive and non-occlusive thrombi of the femoral and popliteal veins were detected in 200 patients (42%). Conventional venography was performed in 47 patients. Color Doppler US and venographic finding agreed in all 12 positive and 35 negative cases involving the femoral veins 100% sensitivity and specificity. Fuest et al. [15] have prospectively compared Doppler US and venography by performing a total of 102 extremities in the diagnosis or exclusion of femoropopliteal thrombosis color Doppler US achieved sensitivity of 95% and specificity of 99%. In other study done by Miller (11) on total number of 216 patients with 220 limbs suspected of acute deep vein thrombosis underwent color Doppler US followed within 24hr by ascending venography, he found sensitivity and specificity of color Doppler US at above-knee level were 98.7% and 100% respectively while corresponding values were 85.2% and 99.2% at below knee level [11] In our study on the bases of clinical assessment the sensitivity was 100%.

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