Value of Doppler Ultrasound in Diagnosis of Clinically Suspected Deep vein Thrombosis

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ABSTRACT: There are few of reports on the deep vein thrombosis in our area, which make the idea that the condition is uncommon. The aim of this study was to find out the role of duplex ultrasound in the diagnosis of patients with Suspected Lower Extremities Deep Venous Thrombosis (DVT) in our hospital. This retrospective study was performed for 150 patients underwent ultrasound examination for clinically suspected DVT between January 2011 and December 2012.105 females, 45 males, age range, (28-55) years with the mean age 51 years. Of the 150 patients, 33(22 %) were positively diagnosed with deep vein thrombosis, while 117 (78%) had negative ultrasound result. Old age is more affecting than young age, and female more than male in getting DVT. The incidence of DVT in the left side 19(58%) was higher than in the right side 14(42%). According to the site of DVT, 14(43%) of all patient had venous thrombosis from CFV to PV Color Doppler is a reliable method of diagnosis of DVT in symptomatic patients. The color Doppler has become the first line in the investigation of DVT in many centers as it provides a non-invasive method of investigation. However, this technique has some limitations in patients with swollen and edematous legs.

KEYWORDS: Doppler imaging, Deep Venous Thrombosis, Ultrasonography

I. INTRODUCTION

Deep vein thrombosis (DVT) is a blood clot formation within deep veins often affects the legs [1] that range from an asymptomatic state (pain, swelling, redness, warmness) to a classic symptomatic. [2] Although most DVT is occult and causes no complications, pulmonary embolism (PE) behind death from DVT, causes as many as 300,000 deaths yearly in the United States of America.[3] Ultrasound of veins is a safe and non-invasive procedure that gives information about the anatomy, physiology, and pathology of both the deep and superficial venous systems.[4]

It is important to appreciate that only a minority of patients actually have the disease when approaching the patient with suspected lower extremity DVT.[5] This low proportion shows the importance of non-invasive testing to decrease the possibility of inappropriate anticoagulation. [6]

Diagnosis of DVT includes; magnetic resonance imaging (MRI), impedance plethysmography, duplex venous ultrasound, and contrast venography. [7]

The gold standard for judging imaging methods is contrast venography but it is rarely performed because of its cost, invasiveness, availability, and other limitations.[8]

The clinical evaluation of DVT is very inaccurate because two-thirds of leg thrombosis is asymptomatic [9]

Ultrasound possesses a very high accuracy for evaluation of arm and thigh with acute DVT, as well as the absence of ionizing radiation, portability, ready repeatability and relatively low cost, [10]. The accuracy of DUS compared with venography for the diagnosis of proximal and calf DVT has been well established. [11,12]

The aim of this work was to elicit the diagnostic value of Doppler ultrasound in revealing Deep Vein Thrombosis (DVT) in our hospital.

II. MATERIAL AND METHODS

This study was conducted in the diagnostic radiology department at King Abdul-Aziz University Hospital (KAU), between January 2011 and December 2012. A retrospective study for reviewing the patient records, the data's of 150 patients who were clinically suspected of having a DVT based on history (swelling, pain, tenderness, redness and hotness in the lower extremities) and underwent for duplex ultrasound of the lower limbs. Patients those with known chronic DVT were excluded from the study. Participants included were 105 females, 45 males, age range (28 -55) years .The study was done after obtaining research ethical approval, from The Ethics Committee of biomedical Ethics, KAU-Faculty of medicine. B-mode and color Doppler

ultrasound studies included in this study were obtained with IU22 Philips system and high-frequency linear array transducer of 12 - 5 MHz.

The duplex ultrasound examination was performed by trained three radiologists, with the patient lying in the supine position with the head elevated about 15-30 degrees to promote venous pooling in the lower leg. Legs slightly flexed and externally rotated to prevent possibility of venous compression behind the knee. The distal external iliac vein located just proximal to the inguinal ligament at the groin. Transverse scan plane was done with the probe slowly moved distally to obtain entire images of the venous system from above the inguinal ligament to the ankle. Series of compression manoeuvres was performed for all veins segments, to evaluate for complete compressibility and for the presence of any intraluminal echoes indicative of thrombus (Figure 1) . Color and spectral Doppler in longitudinal views were used to assess for the presence of spontaneous flow, phasicity with normal respiration and cessation of flow with the Valsalva manoeuvre to show that proximal veins were patent. Colour should fill the lumen of the vessel with distal augmentation.

The diagnosis of DVT was made on the basis of the lack of compressibility of the veins whether there were complete or partial compression, Doppler flow patterns with respiration whether there were decrease, increase, or continues in Doppler waveform, and augmentation with distal compression which indicates if there was thrombus between the transducer and the point of compression and presence of any lack of the blood flow of the veins. Blood clots appeared as echogenic thrombus filling defect in the lumen of veins.

2.1 STATISTICS

Ultrasound findings of the lower limbs veins were collected with demographic data including age and sex of the participants, in a specially designed form and stored in storage device. Then entered the computer and analyzed using SPSS version 16 for the Windows software program, and the results compared between patients with different variables, with a statistical significance level of p value < 0.05. The results presented as frequencies, percentages in tables and figures.

III. RESULT

The total participants included in this study were 150 patients with clinically suspected deep vein thrombosis, who had been examined by duplex ultrasound between January 2011 and December 2012 in the Diagnostic ultrasound of king Abdul-Aziz university Hospital. 105(70%) were female while 45 (30%) of patients were male, age range, (30-55) years with the mean age 51 years and Std.

In 117(78%) patients without DVT in duplex ultrasound demonstrated one or more of the following pathological findings like edema, baker cyst, hematoma, and lymphedema, which are the differential diagnosis for DVT. On another hand, Doppler ultrasound diagnosis showed positive results in 33 (22%) of the total cases (Table 1.)

In our study, there was a significant correlation between age group and the number of the patients with risk of DVT. The number of the patients with DVT was higher in the age group of above 50 years 19(57.6%) as compared to the age group of than under30 years 4(12,1%), and 30-50 years 10(30.3%) (Table 2). Most of the positive cases were female 20(60.6%); 2(6%) under 30y, 6(18.2%) between 31-50 yrs, and 12(36.4%) above 50yrs, while 13(39.4%) were male; 2(6.1%) under 30y, 4(12.1%) between 31-50 and 7(21.2%) above 50y (Table 2).

The incidence of DVT on the left side 19(58%) which was higher than on the right side 14(42%). The most proximal site of thrombus specified at duplex ultrasonography (DUS) was the common femoropopliteal veins in 20(61%), common femoral vein (CFV), and popliteal vein (PV) each one individually 4(12%), the superficial femoral (SFV) vein in 3(9%) and finally 2(6%) in superficial femoropopliteal veins (SFV/PV) (Table 3 and Figure 2).

The 33 patients with positive DVT were classified according to the clinical; symptoms into 5 groups. Swelling first followed by pain, tenderness, redness, and finally hotness. Swelling which included 15 patients (46%) was the commonest clinical presentation for which the US of lower limbs was performed. This was followed by lower limb pain 9 patients (26%), was the second common for which the patients were referred (Table 4).

Symptoms of deep vein thrombosis may be difficult to recognize due to the similarity of symptoms with other health problems. In 117(78%) patients without DVT in duplex ultrasound demonstrated one or more of the following pathological findings like edema (Fig. 4), baker cyst (Figure. 5), hematoma, and lymphedema, which are a differential diagnosis for DVT .Edema was one of the main causes of false-positive ultrasound findings.

IV. DISCUSSION

Deep vein thrombosis (DVT) of lower limbs constitutes a highly frequent reason for consultation in emergency services. It has a high morbidity and mortality if not diagnosed on time.

Doppler ultrasound is the procedure of choice for diagnosing deep vein thrombosis (DVT) using reflected sound waves to show blood flowing through veins. This non-invasive method is very popular and effective in detecting blood clots. This study aimed to describe DVT cases detected by Doppler US among patients clinically suspected of having DVT. In this study, total cases was (150); only 33 (22%) were positively diagnosed with DVT while 117(78%) were negative, our result disagree with (Mosheer A. Goran et al.) who found that about Ninety eight (59.75%) patients were negative by color Doppler US, among 162 suspected DVT patients and the incidence of DVT was 38.1% (64 patients).[13]

Robinson, B J et al who found a total of 36 (25 percent) scans were positive for deep vein thrombosis, while 106 patients (75 percent) showed negative ultrasound result [14], which is approximately closed to our findings (22%) mentioned in our study.

Regarding DVT and patients age; 19(57.6%) the majority of our patients were above 50 years, female represented the highest percentage (60.6%) compared to male (39.4%) this result is in contrast to (Mosheer A. Goran et al.), who reported: (the commonest age group affected being the 30-49(43.7%) year [13] and in agreement with the study conducted by Sanjay M. Khaladkar et al who concluded that the incidence of DVT was highest in the fifth decade. [15]. Also, we disagree with (Rose ann Andreou E et al) who said :(the prevalence of DVT was higher in men (14%) compared to women (9%) (P = 0.001) among the study group.[16] Left side DVT was higher 19(58%) comparing to the right side 14(42%).This result match with the study of (Ouriel K et al) who said: (significant difference between the left compared to the right limb; left limb was involved in 44 patients and right limb in 20 patient. [17]

In our study, we notice that the highest incidence of DVT 14(43%) was in the proximal veins (from common femoral vein to popliteal vein). PV only, CFV only and CFV with FV have the same incidence 4(12%). SFV only, CFV with FV and SFV with PV have the same incidence 2(6%) and the Lower incidence is in FV only 1(3%) without any significance deep vein thrombosis in the distal veins (below the knee). This is in contrast to(Mosheer A.Goran et al.) who found the highest incidence was in the popliteal vein only (32.81%), followed by the posterior tibial vein (26.56%) and the perforators of the calf and around the knee (25%).[13]. Also, we disagreed with (Ouriel K et al.) who reported(The most common site of thrombus was the peroneal vein, which was involved in 595(67%) patient.[17]

Regarding the signs and symptoms, we found that most of the patients (46%) complain of swelling followed by (13%) tenderness, (9%) redness and (6%) complain of hotness. In this result we disagree with (Antoine Elias et al.) who reported; (complain of pain were expressed by 58% of patient (n= 238), swollen leg or edema by 21.5% (n= 38) and both of these complaints by 21% (n= 84).[18]

We notice that there is a high correlation between pulmonary embolism and deep vein thrombosis occurrence in the lower extremities where 70% of patients who have proven PE showed lower limb DVT. This association is also confirmed by (A B van Rossum, et al.) who reported :(the prevalence of DVT in suspected PE is approximately 18%, and among 149 patients proven PE 36-45 %. [19]

Although this is not a comparative study, but from our results, we can say that Doppler ultrasound is superior to other image modalities in detecting lower limb deep vein thrombosis. This is supported by the study of (D. C. Mitchell et al.) in comparing venography with duplex ultrasonography scanning; they found that 65 patients with suspected (DVT) in 68 limbs, venography being contraindicated in four and found a good correlation between the extent of deep vein thrombosis by duplex ultrasonography and venography. [20]



FIGURES AND TABLES

"**Fig. 1**" B-Mode ultrasound showing normal compressible popliteal vein in transverse images (a) & (b) V = popliteal vein and A = polpliteal artery.



"Fig. 2": longitudinal image, B-Mode ultrasound showing echogenic thrombus in popliteal vein

Ultrasound findings	No. of patients	%
Positive DVT	33	22%
Negative DVT	117	78%
Total	150	100%

Table1: Doppler Ultrasound Findings in 150 Patients Clinically Suspected of Having Deep Vein Thrombosis.

Age group	Fe	emale	N	Iale	Т	otal
Under 30 year	2	6%	2	6.1%	4	12.1%
31-50years	6	18.2%	4	12.1%	10	30.3%
Above 50 years	12	36.4%	7	21.2%	19	57.6%
Total	20	60.6%	13	39.4%	33	100%

Table 2: Distribution of 33 Patients with Positive DVT Findings According to Age

DVT Site	No. of patients	%
CFV	4	12%
SFV	3	9%
PV	4	12%
CFV/PV	20	61%
SFV/PV	2	6%
Total	33	100%

Table 3: Anatomical Sites Distribution of Venous Thrombosis in 33 Patients with Positive Finding in Duplex Ultrasound

Clinical Symptoms	DVT patients	Percentage
Swelling	15	46%
Hotness	2	6%
Pain	9	26%
Tendemess	4	13%
Redness	3	9%
Total	33	100%

Table 4: Distribution of Number of Patients with DVT in Relation to the Clinical Symptoms

V. CONCLUSION

Duplex Doppler ultrasound is a non-invasive reliable method for the diagnosis of DVT in symptomatic patients, although it has some limitations in patients with swollen oedematous legs.

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