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Lower Limb Doppler U/S in Patient with Pain and Swelling

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Abstract: ***An analytical prospective study used to characterize the DVT and other related abnormality in Doppler ultrasound in patient with LL pain or swelling or those are highly suggestive for this type of disease in period from January 2013 to September 2016. 210 patient; Firstly patient with differential diagnosis of these selected lower limb disease was underwent successful laboratory and imaging investigation particularly for those suffering from Lower Limb pain and associated symptoms, then the lower limb was examined with real-time sonography, by using of mobile GE LOGIQ 5 ultrasound machine, ideally after a 6-hour fast. Sagittal, transfers views was obtained in order to localize the affected area. The result showed that the most affected age group by DVT was (40-50) years followed by (30-40) and the varicose vein affect the population in age group of (30-40) which is the active age. Lab examination PT/INR and D-dimer very important for correlation with ultrasound sometimes it give abnormal result this due to liver diseases (three patients). DVT was noted in 14.8% from total population, 20.5% having varicose vein, where most people with LL pain and swelling showed normal result in 34.3%. Where the most affected limb more the 50.5% at both site and 29% for the left one, where the majority of the patient suffering from LL pain in 45% as strong indicator for LL Doppler US. Finally pain and swelling can be very good indicator for LL disease in which results in deep veins thrombus which is most important US clinical finding***.

Keywords: Doppler U/S, DVT, pain and swelling, Lower Limb

1. Introduction

Deep venous thrombosis (DVT) is a very common as well as threatening event. An early and accurate diagnosis is mandatory to reduce the risk of pulmonary embolism and the incidence and severity of post-thrombotic syndrome. Noninvasive diagnostic techniques should be given preference in view of the large populations at risk of or suspected of having DVT and the poor reliability of clinical signs and symptoms. In most centers, sonography has superseded venography as the primary technique of detecting DVT over the past few years. This trend was strengthened by recent technologic developments, including color Doppler sonography. However, some authors argue that Doppler sonography is being used inappropriately, as evidenced by the high percentage of normal studies (Fowl et.al 1996). Moreover, there are still several controversies, and the future cannot be foretold with certainty. In this article, we review the detection and characterization of DVT with sonography, with an emphasis on controversial issues.

The diagnosis of DVT with continuous-wave Doppler sonography was one of the first applications of sonography, in the late 1960s (Sigel et.al 1968). In the early 1980s, B-mode sonography became the technical standard, (Laroche et.al 1983, Raghavendra et.al 1984). The aims of the sonographic examination are not only determination of the presence of a thrombus but also evaluation of the extent of the thrombus (particularly its upper limit), its age (of prognostic interest), and its attachment to the venous wall (partially or totally occlusive thrombus, attached or free-floating thrombus). Moreover, the ultrasound examination may be useful even when negative for DVT by disclosing other causes of the signs or symptoms. (Dauzat, et.al 1997).

1.1. Diagnostic Criteria

The sonographic diagnosis of DVT makes use of various tests and criteria in the demonstration of thrombi. Major criteria are the presence of echogenic intraluminal material, vein incompressibility, and the absence of spontaneous or elicited blood flow; minor criteria include an enlarged vein diameter, venous wall and valve immobility, upstream and downstream spontaneous blood flow echogenicity, and enlarged collateral veins with increased flow. (Dauzat, et.al 1991). Vein incompressibility on the compression test is the most widely used criterion for the positive diagnosis of DVT: the vein can no longer be collapsed by moderate pressure with the ultrasound probe because of the presence of the thrombus. Thrombus echogenicity is a major, direct sign (Figure 1) whose reliability depends on the contrast resolution and proper setting of the dynamic range of the B-mode system. Precise adjustment during scanning of the contralateral side is recommended to set the gain at the highest level that allows a noise-free lumen to be displayed.
A spontaneous blood flow signal can be detected with continuous-wave, pulsed (duplex), or color Doppler sonography in proximal veins (i.e, popliteal, femoral, and iliac veins). Color-coded Doppler systems may allow the detection of spontaneous flow in small calf veins, and the color signal of adjacent arteries offers a useful landmark in that regard. The vein patency can be evaluated with dynamic tests that increase or accelerate venous flow: compression of muscles upstream from the probe or limb raising produces enhanced Doppler signals in normal veins.

The vein diameter is consistently enlarged at the acute stage of thrombosis. This sign becomes obvious when the occluded vein is compared with the contralateral, normal vein. Immobility of the venous wall and valves and spontaneous blood flow echogenicity (resulting from red cell aggregation

during blood stasis) are additional signs that may be useful when the thrombus itself is hypoechoic. (Dauzat, et.al 1997).

1.2 Which tests and which criteria should be used?

Many authors rely on the compression test alone, while others use a combination of criteria. Reports in the literature are conflicting. (Cogo et.al 1993. Wester et.al 1994) For Mussurakis et al, 1990, the sensitivity and specificity of the compressibility criterion were, respectively, 100% and 100% for proximal DVT and 50% and 100% for isolated calf DVT, while the sensitivity and specificity of echogenic intraluminal material were, respectively, 50% and 100%. (Mussurakis et al, 1990) Color Doppler imaging offers interesting advantages in special situations in which the compression test is limited (Langholz et.al 1991). It may help demonstrate flow in veins that cannot be easily compressed, e.g, and the lower part of the superficial femoral vein in patients with large thighs or the tibial veins in patients with large or swollen calves.

This modality is proving very useful in clinical practice for the rapid detection of deep veins and immediate assessment of their patency. Enlarged vein diameter, echogenic intraluminal material (especially at the calf level), or both draw attention to the portion of the vein in which compressibility must be tested.

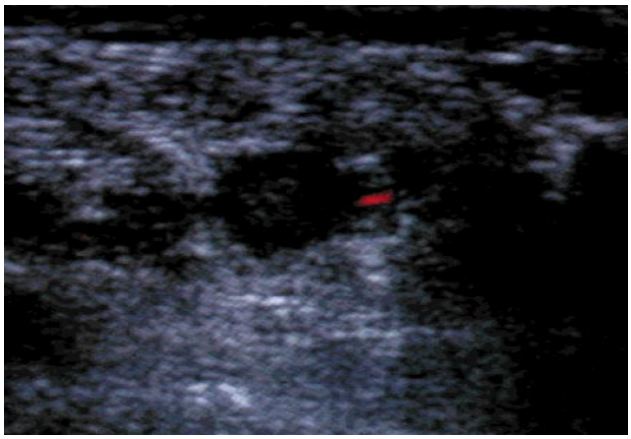

Figure 1: Recent (less than 4 days) thrombosis of a posterior tibial vein (transverse sonogram). The hypoechoic clot enlarges the vein. Demonstration of the adjacent artery with color Doppler facilitates identification of the vein

2. Material and Method

Firstly patient with differential diagnosis of these selected lower limb disease was underwent successful laboratory and imaging investigation particularly for those suffering from Lower Limb pain, swelling and associated symptoms, then the lower limb was examined with real-time sonography, by using of mobile GE LOGIQ 5 ultrasound machine having general feature of (Advanced 3D, Anatomical M-Mode, Basic, B-Flow, Cardiac Calculations, Cardiac-App, CD Read Write, Coded-Contrast, Color Doppler, CW Doppler, DICOM, DVD Read Write, Easy 3D, ECG, LOGIQ-View, MO Drive, OB/Gyn Calculations, Power Doppler, PW Doppler, Tissue Harmonics Imaging (THI/NTHI), Urology Calculations and Vascular Calculations), ideally after a 6-hour fast. Sagittal and transverse views are used using both a standard transducer and a higher frequency transducer. The color Doppler flow was performed and many particular diagnosis was obtained according to available data which showed below:

Figure 2: showed the compression test at the level of the adductor canal, where it is inadequate at level of adductor canal rather, and additional presses on the vein against transducer from below with flat hand

3. Results

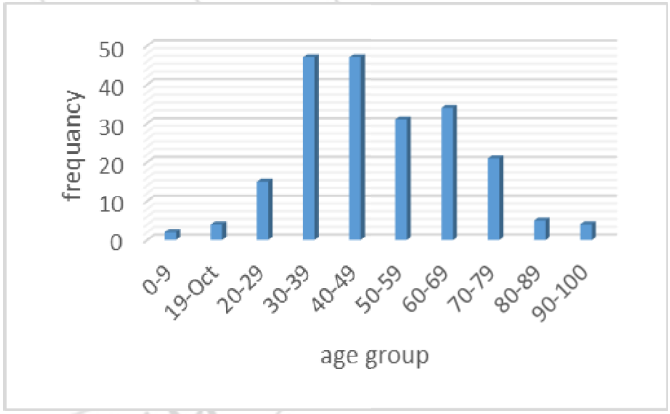

Figure 3: Demonistrate the common age group affected by LL pain and swlling.

Table 1: Showed Frequency Distribution of ultrasound finding in patient with LL swelling and pain

US finding	Frequency	Percent
DVT	31	14.8
Varicose vein	43	20.5
Cellulitis	21	10.0
Baker cyst	11	5.2
Thrombosis	9	4.3
Ischemia	18	8.6
Hematoma	5	2.4
Normal	72	34.3
Total	210	100

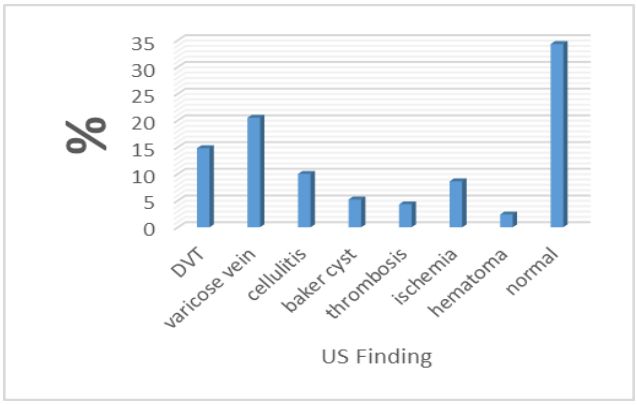

Figure 4: Showed the % of US fingding for study population

Table 2: Cross-tabulation between the US finding and age groups

Age Vs US fining		Ultrasound finding						Total
		DVT	varicose vein	Cellulitis	baker cyst	thrombosis	ischemia	
Age	0-9	1	1	0	0	0	0	2
	10-19	3	0	1	0	0	0	4
	20-29	4	9	1	0	0	0	14
	30-39	22	16	3	1	3	2	47
	40-49	25	14	3	0	4	1	47
	50-59	17	6	1	2	1	3	30
	60-69	15	4	1	0	6	8	34
	70-79	14	0	1	1	0	5	21
	80-89	3	0	1	0	0	1	5
	90-100	1	0	0	2	0	1	4
Total		105	50	12	6	14	21	208
Correlation were significant at p<0.05, p= 0.000								

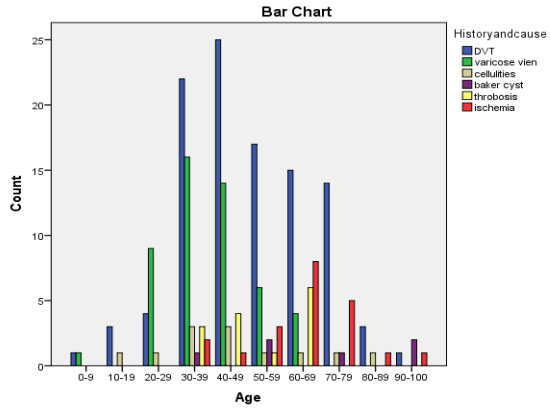

Figure 5: Cross-tabulation between the US finding and age groups.

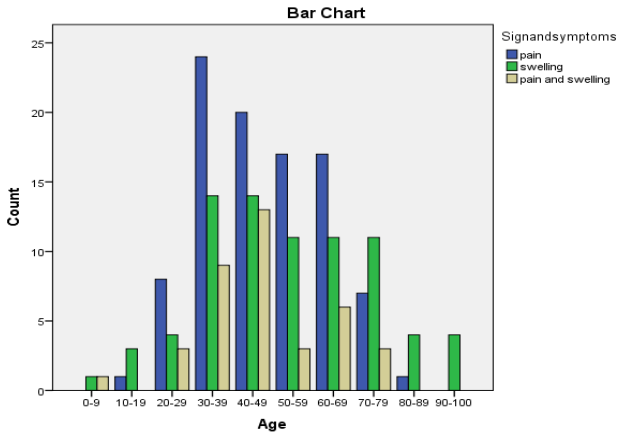

Figure 6: Correlation between the common signs and age groups

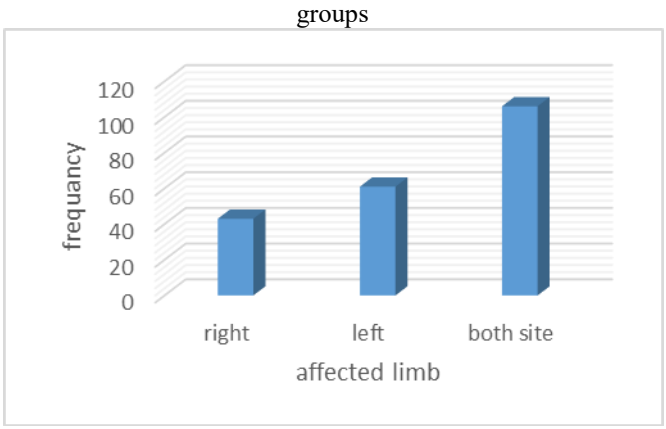

Figure 7: Showed the frequancy distribution of the most affected limb after US scan.

Table 3: Cross-tabulation between the affected limbs and age groups

Age Vs affected limb		Affected limb			Total
		right	left	both site	
Age	0-9	1	1	0	2
	10-19	2	0	2	4
	20-29	0	6	9	15
	30-39	7	16	24	47
	40-49	9	15	23	47
	50-59	6	7	18	31
	60-69	11	4	19	34
	70-79	6	7	8	21
	80-89	0	2	3	5
	90-100	1	3	0	4
Total		43	61	106	210
Correlation were significant at p<0.05, P= 0.128					

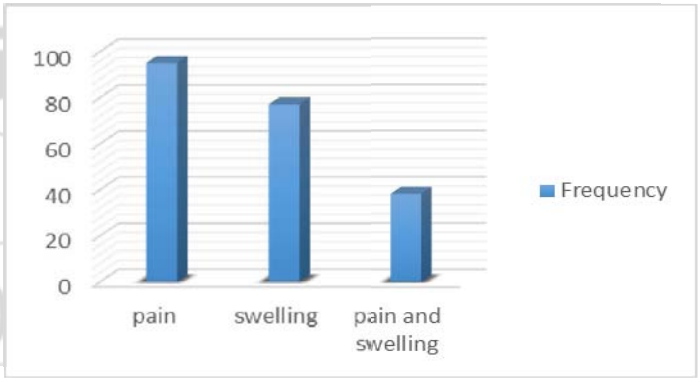

Figure 8: Demonistrate the most common sign in which the patient come with

4. Discussion

A frequency distribution were performed for the ultrasound finding in 210 patient underwent Doppler US for patient indicated by lower limb pain swelling or other pathological indication and US result showed that 43 patient 20.5% were diagnosed as varicose vein, and DVT represent more than 14.8% (31) patient which assumed to be as high as it can lead to other pathological abnormalities and increase the patient mortality so further intervention is required to assess and to manage these patient where the majority of the patient come with normal ultrasound scan at both Doppler mode or normal LL US, which represent 34.3% from the study population. Lower vein ischemia were noted in 8.6% in study population

which is totally manifested as lower limb color changes due to loss of O_2 level at level after ischemia. Table (1), figure (3).

Age of the patient may be one of the most important related factor in causes of LL DVT and other co-morbidity. A correlation were performed to assess if their significant difference between the age group and the US finding or not where the study denoted that at P<0.05. Correlation were significant at p=0.000. where the most affected age group by DVT was 40-50 years (25) patient followed by (30-40) years as (22) patient from the study population, and the varicose vein affect the population in age group of (30-40) more than the rest of the population age and it found to be in more than (16) patient followed by (40-50) in 14 patient where the ischemia and thrombosis affect the oldest age group here which is mainly affect patient with age of (60-80) years. As in table (2) figure (1 and 4).

Medically it most important to have a full historical background about the patient clinical problem (signs and symptoms even family history and full physical examination it should be carried out) here the most clinical indication where the patient come by it was pain, swelling and both. The study revealed that a strong correlation were noted between the age group and associated symptoms in age group of (30-40) mostly come by lower limb pain, same result noted for (40-50), (50-60) and (60-70). Where the pain here was consider as strong indicator for common US finding here. P=0.124. As figure (7 and 5).

It important to correlate the patient blood investigation with the US finding which may help in guiding the diagnosis toward the better result. For DVT high pt/INR, high d-dimer, normal blood. Varicose vein normal blood and normal pt/INR Cellulitis: normal blood, high WBCS, Baker cyst: normal blood, high WBCS. Thrombosis: High PT/INR, normal blood. Ischemia: high glucose, normal blood. Hematoma: high WBCS, as stated by John et.al 2005. Current plasma markers for diagnosis of deep venous thrombosis (DVT) allow for exclusion of the diagnosis, but lack adequate specificity to establish the diagnosis. Thus, a prospective study was performed to determine the sensitivity and specificity of plasma assays for D-dimer, soluble P-selectin (P-selectin), and total micro particles in patients with documented DVT by duplex ultrasound. Three groups of individuals were examined: 30 normal; 22 positive for DVT on duplex ultrasound (Group 2); and 21 symptomatic, but negative on duplex ultrasound for DVT (Group 3). Group 1 individuals had D-dimer values of 1.53±0.12 mg/l and P-selectin values of 0.34±0.05 ng/mg total protein. Group 2 vs. Group 3 individuals had D-dimer values of 7.57±2.03 vs. 3.19±0.79 mg/l, p=0.02; P-selectin values of 0.98±0.11 vs. 0.55±0.08 ng/mg total protein, p<0.01; and micro particle values of 129±17% vs. 99±12% of control, p=ns. Using a logistic regression model with dichotomous variables, we determined a sensitivity of 73%, specificity of 81%, and accuracy of 77% when combining D-dimer, soluble P-selectin, and total micro particles to differentiate Group 2 from Group 3 patients. Logistic regression using continuous variables yielded similar results (p=0.05).This study demonstrates that plasma markers for DVT can be developed and achieve moderate sensitivity and specificity in diagnosing DVT. However for clinical applicability, the sensitivity/specificity will need to be improved. These studies also suggest the importance of soluble P-selectin in assessing DVT in humans. John et.al 2005.

frequency distribution of ultrasound finding of 21 patients which shows 14.8 % DVT, 20.5 % varicose vein, 10.0 % cellulitis, 5.2 % baker cyst, 4.3 % thrombosis, 8.6 % ischemia, 2.4 % hematoma and 34.3 % normal. Figure (1).

Where the most affected limb left side and the majority come with pain in both side of the lower limbs as in figure (6 and 7).

5. Conclusion

Duplex or color Doppler examination of the deep veins of the lower limbs is certainly the technique of choice for the primary detection of DVT in symptomatic patients, offering remarkably high sensitivity. In asymptomatic patients at risk of DVT, sonography offers lower sensitivity but can still be used as a screening method, reducing the need for venography to patients at very high risk of DVT in whom sonographic results remain negative or questionable. For LL sonography according to this study; pain was strong indicator of such finding where the lab result should be correlated and this lead to better and early detection of DVT.

References

[1] Barnes RW, Nix ML, Barnes CL, et al: Perioperative asymptomatic venous thrombosis: role of duplex scanning versus venography. J Vasc Surg 1989; 9: 251.
[2] Cogo A, Lensing AW, Prandoni P, et al: Comparison of real-time B-mode ultrasonography and Doppler ultrasound with contrast venography in the diagnosis of venous thrombosis in symptomatic outpatients. Thromb Haemost 1993; 70: 404.
[3] Dauzat M, Laroche JP, de Bray JM, et al: Sonographic evaluation of lower limb veins [in French]. In Dauzat M, ed: Ultrasonographie Vasculaire Diagnostique. The´orie et Pratique. Paris, Vigot, 1991, p. 386.
[4] Dauzat MM, Laroche JP, Charras C, et al: Realtime B-mode ultrasonography for better specificity in the noninvasive diagnosis of deep venous thrombosis. J Ultrasound Med 1986; 5: 625.
[5] Fowl RJ, Strothman GB, Blebea J, et al: Inappropriate use of venous duplex scans: an analysis of indications and results. J Vasc Surg 1996; 23: 881.
[6] Langholz J, Heidrich H: Sonographic diagnosis of deep pelvic/leg venous thrombosis: is color-coded duplex sonography ‘‘superfluous’’? [in German]. Ultraschall Med 1991; 12: 176.
[7] Laroche JP, Dauzat M: Venous real-time ultrasound. Technical proposal illustrated with first results in the diagnosis of deep venous thrombosis [in French]. Journal d’Imagerie Me´dicale 1983; 1: 193.
[8] Mussurakis S, Papaioannou S, Voros D, et al: Compression ultrasonography as a reliable imaging monitor in deep venous thrombosis. Surg Gynecol

Obstet 1990; 171: 233.
[9] Oishi CS, Grady-Benson JC, Otis SM, et al: The clinical course of distal deep venous thrombosis after total hip and total knee arthroplasty, as determined with duplex ultrasonography. J Bone Joint Surg Am 1994; 76: 1658.
[10] Philbrick JT, Becker DM: Calf deep venous thrombosis—a wolf in sheep's clothing? Arch Intern Med 1988; 148: 2131.
[11] Raghavendra BN, Rosen RJ, Lam S, et al: Deep venous thrombosis: detection by high-resolution real-time ultrasonography. Radiology 1984; 152: 789.
[12] Reis SE, Polak JF, Hirsch DR, et al: Frequency of deep venous thrombosis in asymptomatic patients with coronary artery bypass grafts. Am Heart 991; 122: 478?
[13] Sigel B, Popky G, Wagner DK, et al: Doppler ultrasound method for diagnosing lower extremity venous disease. Surg Gynecol Obstet 1968; 127: 339.
[14] Wester JPJ, Holtkamp M, Linnebank ERM, et al: Non-invasive detection of deep venous thrombosis: ultrasonography versus duplex scanning. Eur J Vasc Surg 1994; 8: 357.

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