

## Risk Factors of Deep Venous Thrombosis in Duplex and Colour Doppler Ultrasound at Tikur Anbessa Specialized Hospital, Addis Ababa, Ethiopia

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**Background:** Deep venous thrombosis is a major health problem with high morbidity and mortality worldwide. Thus early, correct and definitive diagnosis is crucial in assessing thromboembolic risk and initiating therapy. In this regard Patients at risk must be identified and given appropriate prophylaxis to reduce Venous Thromboembolism related morbidity and mortality. The main objective of this study was to determine common risk factors of deep venous thrombosis (DVT) and the common sites involved by DVT in ultrasound proven cases.

**Methods:** This was a prospective cross-sectional study which included all patients who had proven deep venous thrombosis by Doppler and duplex ultrasound at Tikur Anbessa Specialized Hospital (TASH). Senior radiology residents collected the data after getting approval from consultant radiologists. Analysis was undertaken by principal investigator.

**Results:** There were a total 81 ultrasound proven cases of DVT involving the extremities during the study period out of which 34.6% were males and 65.4% females. The majority (58%) were under the age of 40 years. Malignancy was the most common identified risk factor (30.9% of the cases) followed by prolonged immobilization 19.8%, pregnancy related problems 6.2% and severe trauma 6.2% of the patients. No apparent risk factor was found in 12.3%. Swelling was noted in 93.8% of the participants in combination with other manifestations or alone; whereas pain was noted in 70.4% of the patients. The study showed 59.3% had involvement of the left lower limb only; 11.1% had involvement of both lower limbs. The upper extremities were affected in only one patient having bilateral involvement of brachiocephalic veins. According to the study 84% of the patients had combined involvement of the deep veins of the lower extremities extending from the common iliac veins to the popliteal veins. The study revealed that 28.4% of participants were found to have combined involvement of the common femoral vein (CFV), superficial femoral vein (SFV) & popliteal vein; 22.2% had combined involvement of the CFV & SFV.

**Conclusion:** From the study we concluded that Malignancy, prolonged immobilization, pregnancy related problems and major trauma were the most common risk factors noted for DVT and Swelling was the most common presenting manifestation. Majority of the patients had multiple site deep vein involvement extending from the common iliac to the popliteal veins.

**Key words:** Risk, Factors, Deep, Vein, Thrombosis, Duplex, Doppler.

### Introduction

Deep venous thrombosis (DVT) and venous thromboembolism (VTE) are major health problems with high morbidity and mortality worldwide<sup>1</sup>. Deep vein thrombosis is the third most common cardiovascular disease after acute coronary syndromes and stroke, affecting 2 million individuals in the United States each year<sup>2,3</sup>. DVT is quoted as a major health problem and one of the most common preventable causes of hospital deaths in the western world where the incidence is one case of DVT and 0.5 cases of PE per 1000 population/year<sup>4</sup>. Hospitalized patients are especially at risk for VTE as most have multiple risk factors. Autopsy studies have shown the incidence of VTE in hospitalized patients to be as high as 34.7% with fatal pulmonary embolism in 9.4%<sup>5,6</sup>.

Deep vein thrombosis commonly affects the leg veins (such as the femoral vein or the popliteal vein) or the deep veins of the pelvis which made them common sources of serious complications<sup>7-9</sup>. According to studies conducted in China and Nigeria identified associating risk factors included immobilization related to either surgical or medical causes, cigarette smoking, malignancies, varicose veins, local trauma, HIV infection and DM were implicated<sup>10-11</sup>.

As that of the African setting; if not worse, there is scarcity of studies conducted about DVT in Ethiopia. A five-year prospective study done at Addis Ababa revealed that 95% of the patients presented with lower and 5% with upper limb DVT<sup>12</sup>. Given that DVT is not uncommon and it also may be associated with severe complications; early, correct and definitive diagnosis is crucial in assessing thromboembolic risk and initiating therapy. Clinical assessment of patients with suspected DVT is difficult and often inaccurate as it fails to detect DVT in 50% of cases while it may yield erroneous results in 30% of cases<sup>13, 14</sup>. clearly imaging evaluation of patients with suspected DVT provide important information that can help clinicians establish the correct diagnosis. Contrast-enhanced venography is the standard of reference against which other methods of diagnosing DVT are compared. Because of its noninvasiveness, absence of ionizing radiation and portability, sonography has become useful tool for evaluating patients with suspected DVT. The sensitivity and specificity of sonography in the diagnosis of DVT is as high as 88–100% and 92–100%, respectively<sup>15, 16</sup>.

The purpose of this study was to investigate the associated risk factors of DVT and to evaluate the common presenting clinical manifestations as well as the common sites of occurrence of DVT in patients sent to department of radiology at Tikur Anbessa Specialized Hospital who were clinically suspected to have the problem and for whom ultrasound evaluation was done so that recommendations will be made based of the results.

### **Patients and Methods**

The study was conducted from February 2011 to October 2012 G.C at Tikur Anbessa Specialized Hospital, Addis Ababa. A prospective cross-sectional study to analyze the common risk factors of deep venous thrombosis in Duplex and Doppler ultrasound proven cases of deep venous thrombosis at Tikur Anbessa Specialized Hospital. During study period all patients who were diagnosed to have deep venous thrombosis by B-mode and Doppler ultrasound were included in the study. An English version data collection format was prepared and questions about demographic characteristics ( age and sex), presenting signs and symptoms, sites of deep venous thrombosis detected, and risk factors for deep venous thrombosis were included and filled by final year radiology residents after getting approval from consultant radiologists for each case. An interview method and diagnostic evaluation using Doppler ultrasound were done by using the data collection format. Prior to the data collection a brief explanation were given to the data collectors about the questionnaire.

The ultrasound examination was performed using a 3.5 MHz convex array transducer and 5 MHz linear array transducer (Toshiba *Nemio XG*). The ultrasonographic criteria for the diagnosis of acute DVT included visualization of light echogenic intraluminal thrombus, lack of phasic venous flow, lack of flow augmentation, and loss of normal vein compressibility on light probe pressure. The ultrasonographic features of chronic DVT included the appearance of a bright, echogenic, intraluminal thrombus, a recanalized vein lumen with securely attached thrombus, and the presence of multiple venous collaterals. Raw data was compiled and analyzed by using SPSS window version 15 computer software and the results description tables were displayed. Individual verbal consent was sought from the patients who were included in the study. The subjects were informed that their personal data will not be disclosed to anyone. Department research committee approval was sought and obtained.

### **Results**

There were a total 81 ultrasound proven cases of DVT involving the extremities during the study period of which 28(34.6%) were males and 53(65.4%) were females, giving a male to female sex ratio of 1 : 1.9. Their ages ranged from 16 to 71 years with the mean and median ages of 39.93 years and 39 years respectively (Table 1). The majority (58%) of the patients were aged under 40 years with a peak incidence (27.2%) in the 31–40 years age group. Tables 2 and 3 show the risk factors of DVT in the study population. Malignancy accounted for 25 (30.9%) of the patients of which cervical cancer accounted for 8(9.9%) of the total followed by breast cancer for 7(8.6%), lymphoma for 5(6.2%) and

ovarian cancer for 3(3.7%) of the total respectively. Other risk factors included prolonged immobilization (19.8%), pregnancy related problems and severe trauma each accounting for 5(6.2%) cases. In this study, 74.1% of the cases had single risk factor for the DVT, 13.6% had more than one risk factor and the rest 10(12.3%) had no known risk factor for their DVT (Table 4).

Forty five (55.6%) of the patients presented with pain and swelling of the affected limbs when they come for evaluation. Twenty three (28.4%) gave a history of swelling as their main presenting manifestation. Isolated pain and tenderness were noted in 4(4.9%) and 1(1.2%) of the patients respectively. Positive Homan’s sign was noted in only one patient (Table 5). Generally swelling was noted in 76(93.8%) of the participants in combination with other manifestations or alone; whereas pain was noted in 57(70.4%) of the patients (Table 6). Out of the 81 patients with DVT, 48(59.3%) had involvement of the left lower limb only; whereas 23(28.4%) had isolated involvement of the right lower limb. Nine (11.1%) had involvement of both lower limbs. The upper extremities were affected in only one patient who had bilateral involvement (Table 7).

As to the site of deep venous thrombosis, the majority (84%) had combined involvement of the deep veins of the lower extremities extending from the common iliac vein to the popliteal veins. The study revealed that 23(28.4%) of participants were found to have combined involvement of the CFV, SFV and popliteal vein; whereas 18 (22.2%) and 10 (12.3%) had combined involvement of the CFV & SFV and External Iliac Vein (EIV), CFV, SFV & popliteal vein respectively (Table 8). Isolated single vein involvement was noted in the popliteal vein in 3(3.7%) of patients and CFV, Profunda Femoral Vein (PFV) & brachiocephalic veins, one patient in each case. The most commonly involved veins in general were superficial femoral vein and common femoral vein noted in 69(85.2%) of the patients in each case, followed by the popliteal vein in 51(63.0%) patients, the external iliac vein in 24(29.6%) patients, profunda femoral vein in 7(8.6%) patients, calf veins in 7(8.6%) patients and the common iliac vein in 4(4.9%) patients respectively. the brachiocephalic vein was affect in only one patient who had bilateral involvement (Table 9).

**Table 1.** Age and Sex Distribution of DVT of Extremities,

Age group in years	Sex		Total No (%)
	Male No (%)	Female No (%)	
11-20	1(1.2%)	3(3.7%)	4(4.9%)
21-30	7(8.6%)	14(17.3%)	21(25.9%)
31-40	7(8.6%)	15(18.5%)	22(27.2%)
41-50	8(9.9%)	11(13.6%)	19(23.5%)
51-60	2(2.5%)	6(7.4%)	8(9.9%)
61-70	2(2.5%)	4(4.9%)	6(7.4%)
71-80	1(1.2%)	0(.0%)	1(1.2%)
<b>Total</b>	<b>28(34.6%)</b>	<b>53(65.4%)</b>	<b>81(100.0%)</b>

**Table 2.** Distribution of risk factors of DVT, Addis Ababa in TASH, Oct. 2012

Risk factors of deep venous thrombosis	Sex		Total No (%)
	Male No (%)	Female No (%)	
Malignancy	5(6.2%)	20(24.7%)	25(30.9%)
Prolonged immobilization	6(7.4%)	10(12.3%)	16(19.8%)
Pregnancy related problems	0(.0%)	5(6.2%)	5(6.2%)
Severe trauma	4(4.9%)	1(1.2%)	5(6.2%)
Major surgery	3(3.7%)	0(.0%)	3(3.7%)
Heart attack or congestive heart failure	0(.0%)	3(3.7%)	3(3.7%)
Advanced age	1(1.2%)	2(2.5%)	3(3.7%)
Prolonged immobilization and advanced age	2(2.5%)	1(1.2%)	3(3.7%)
HIV infection	2(2.5%)	1(1.2%)	3(3.7%)
Diabetes mellitus and HIV	1(1.2%)	1(1.2%)	2(2.5%)
Diabetes mellitus	0(.0%)	1(1.2%)	1(1.2%)
Pregnancy and prolonged immobilization	0(.0%)	1(1.2%)	1(1.2%)
Previous DVT	0(.0%)	1(1.2%)	1(1.2%)
No apparent risk factor noted	4(4.9%)	6(7.4%)	10(12.3%)
<b>Total</b>	<b>28(34.6%)</b>	<b>53(65.4%)</b>	<b>81(100.0%)</b>

**Table 3** Distribution of malignant risk factors of DVT,

Malignancy as Risk factors of DVT	Frequency
Cervical Cancer	8
breast cancer	7
Lymphoma	5
ovarian cancer	3
CML	1
pancreatic cancer	1
<b>Total</b>	<b>25</b>

**Table 4.** Distribution of Number of Risk Factors of DVT Occurring per Patient.

Risk factors of deep venous thrombosis	Sex		Total No (%)
	Male No (%)	Female No (%)	
Single risk factor	18(22.2%)	42(51.9%)	60(74.1%)
More than one risk factor	6(7.4%)	5(6.2%)	11(13.6%)
No apparent risk factor noted	4(4.9%)	6(7.4%)	10(12.3%)
Total	28(34.6%)	53(65.4%)	81(100.0%)

**Table 5.** Distribution of Presenting Signs and Symptoms of DVT in Extremities.

Presenting signs and symptoms	Sex		Total No (%)
	Male No(%)	Female No(%)	
Pain and swelling	14(17.3%)	31(38.3%)	45(55.6%)
Swelling	8(9.9%)	15(18.5%)	23(28.4%)
pain, tenderness & swelling	5(6.2%)	2(2.5%)	7(8.6%)
Pain	0(.0%)	4(4.9%)	4(4.9%)
Tenderness	1(1.2%)	0(.0%)	1(1.2%)
Pain, tenderness, swelling and Homan's sign positive	0(.0%)	1(1.2%)	1(1.2%)
Total	28(34.6%)	53(65.4%)	81(100.0%)

**Table 6.** The Frequency of Occurrence of Individual Signs and Symptoms of DVT.

Presenting signs and symptoms	Sex		Total No(%)
	Male No(%)	Female No(%)	
Swelling	27(33.3%)	49(60.5%)	76(93.8%)
Pain	19(23.5%)	38(46.9%)	57(70.4%)
Tenderness	6(7.4%)	3(3.7%)	9(11.1%)
Homan's sign positive	0(.0%)	1(1.2%)	1(1.2%)

**Table 7.** Distribution Limbs Involved by DVT in Extremities.

Limb involved	Sex		Total No(%)
	Male No(%)	Female No(%)	
left lower limb	13(16.0%)	35(43.2%)	48(59.3%)
Right lower limb	10(12.3%)	13(16.0%)	23(28.4%)
Right and left lower limb	5(6.2%)	4(4.9%)	9(11.1%)
right and left upper limb	0(.0%)	1(1.2%)	1(1.2%)
Total	28(34.6%)	53(65.4%)	81(100.0%)

**Table 8.** Anatomical Distributions of DVT in the Extremities.

Site of Deep Venous Thrombosis	Sex		Total No (%)
	Male No (%)	Female No (%)	
CFV, SFV & poplital vein	7(8.6%)	16(19.8%)	23(28.4%)
CFV & SFV	7(8.6%)	11(13.6%)	18(22.2%)
EIV, CFV, SFV & poplital vein	2(2.5%)	8(9.9%)	10(12.3%)
SFV, poplital vein	3(3.7%)	2(2.5%)	5(6.2%)
Poplital vein	1(1.2%)	2(2.5%)	3(3.7%)
CIV, EIV, CFV, SFV	2(2.5%)	1(1.2%)	3(3.7%)
EIV, CFV, SFV	2(2.5%)	1(1.2%)	3(3.7%)
EIV, CFV, SFV, PFV & Poplital vein	0(.0%)	2(2.5%)	2(2.5%)
EIV & CFV	2(2.5%)	0(.0%)	2(2.5%)
EIV, CFV, PFV, SFV, poplital vein and calf veins	0(.0%)	2(2.5%)	2(2.5%)
Poplital and calf vein	0(.0%)	2(2.5%)	2(2.5%)
EIV, CFV, SFV, PFV, poplital and calf veins	0(.0%)	1(1.2%)	1(1.2%)
CIV, EIV, CFV, SFV, PFV & poplital vein	1(1.2%)	0(.0%)	1(1.2%)
CFV, SFV and calf veins	0(.0%)	1(1.2%)	1(1.2%)
CFV, poplital and calf veins	1(1.2%)	0(.0%)	1(1.2%)
CFV & poplital vein	0(.0%)	1(1.2%)	1(1.2%)
CFV	0(.0%)	1(1.2%)	1(1.2%)
PFV	0(.0%)	1(1.2%)	1(1.2%)
Brachiocephalic vein	0(.0%)	1(1.2%)	1(1.2%)
<b>Total</b>	<b>28(34.6%)</b>	<b>53(65.4%)</b>	<b>81(100.0%)</b>



**Table 9.** General Occurrence of DVT in Specific Anatomical Sites of the Extremities.

Site of deep venous thrombosis	Sex		Total No (%)
	Male No (%)	Female No (%)	
Superficial femoral vein	24(29.6%)	45(55.6%)	69(85.2%)
Common femoral vein	24(29.6%)	45(55.6%)	69(85.2%)
Popliteal vein	15(18.5%)	36(44.4%)	51(63.0%)
External iliac vein	9(11.1%)	15(18.5%)	24(29.6%)
Profunda femoral vein	1(1.2%)	6(7.4%)	7(8.6%)
Common iliac vein	3(3.7%)	1(1.2%)	4(4.9%)
Calf veins	1(1.2%)	6(7.4%)	7(8.6%)
Brachiocephalic vein	0(0.0%)	1(1.2%)	1(1.2%)

### Discussion

In order to detect patients with DVT and manage them at the right time the risk factors which predispose patients to DVT and the clinical manifestations should be well known. The study revealed that out of the 81 patients with DVT, the majority were females accounting for 65.4% of the total. This was found to be in line with a study done in Addis Ababa <sup>12</sup>. But another study done in Azadi Hospital in Duhok <sup>17</sup> showed that the majority of the participants were males accounting for 59.37% showing the difference with our study. This variation can be explained by the fact that the sample size in both studies are small. Fifty eight percent of the patients were found to be less than 40 years of age, the commonly affected age group being 31-40 years. This compares favourably with the findings in the study done in Addis Ababa <sup>12</sup> and in Azadi Hospital in Duhok <sup>17</sup>. To the contrary a Chinese study <sup>10</sup> showed predominance of DVT in the old age and smokers which may be due to the difference in life style and higher life expectancy in the later.

According to the study the most commonly noted risk factors for the study population were malignancy of some kind (30.9%), prolonged immobilization (19.8%), pregnancy related problems (6.2%) and severe trauma (6.2%) which roughly corresponds to a study conducted in Singapore general hospital in which case malignancy accounted for 36% followed by major surgery (20%) and prolonged bed rest (16%) <sup>18</sup>. But in a prospective study done by Gebremedhin and Shamebo <sup>12</sup> in Addis Ababa, out of the 66 patients with DVT, 40% had pregnancy and pregnancy-related conditions as their risk factors for DVT. Immobilization was considered a risk factor in 18% of cases. Our study revealed that the majority (87.7%) of the patients was found to have one or more risk factor for their DVT, whereas the remaining 12.3% had no identified risk factor. This is in accordance with most studies done world wide <sup>11,12,18,18</sup>.

Regarding the presenting manifestations, most patients had combined manifestations. Generally swelling was the most common presenting symptom which was detected in 93.8% of the patients corresponding to findings done in Singapore general hospital<sup>18</sup> and Queen Mary Hospital in Hong Kong<sup>20</sup>. Pain and tenderness were the next commonly encountered manifestations.

Our study showed that 98.8% of the patients were having DVT in their lower limbs. Only 1.2% of them had the DVT in the upper extremities, which is also noted in other studies<sup>8,9,12</sup> too. The left lower limb was involved in majority of the patients ( 59.3%), comparable with studies done in Nigeria<sup>11</sup> and Duhok<sup>17</sup>. Isolated involvement of the right lower limb was noted in 28.4% of our patients, the remaining 11.1% had bilateral lower limb involvement.

According to the study 84% of the patients were found to have combined involvement of the deep veins of the lower extremities extending from the common iliac vein to the popliteal veins. A study done in Queen Mary Hospital in Hong Kong<sup>20</sup> showed that most patients had DVT that extended from the popliteal vein to the external iliac or common iliac veins. Another study done in Germany revealed that 50% of patients had femoro-popliteal, 25.0% a femoral, and 25.0% a popliteal vein thrombosis<sup>21</sup>. These studies are roughly in accordance with our finding even though there was a difference in their methodology. With regard to the calf veins, the study revealed that 8.6% of the patients had involvement of the calf veins by DVT, lower than the results found in a Nigerian study<sup>11</sup> which may be due to the significant difference in the size of the study population and the smaller number of the subjects in both studies as well.

### **Conclusion**

Malignancy, prolonged immobilization, pregnancy related problems and major trauma were the most common risk factors noted for DVT in the study population. Swelling was the most common presenting manifestation with other sign or symptoms. The left lower limb was the most commonly affect limb by DVT. Majority of the patients had multiple site deep vein involvement extending from the common iliac to the popliteal veins.

### **Recommendations**

Extensive research should be conducted about DVT in general and risk factors of DVT in particular. Clinicians should always be conscious that patients who have any of the risk factors may develop DVT any time. Patients who have any of the risk factors should be told to come to hospital if they develop any of the signs or symptoms so that early diagnosis and management is made to reduce the complications.

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