

The Role of Daily Measurement of Lower Limb Circumference in Early Diagnosis of Deep Vein Thrombosis in the Presence of Other Risk Factors in Patients Admitted to Infectious Diseases Ward of Imam Reza Hospital, Mashhad, during 2012-2013

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ABSTRACT

Introduction: Considering the high rate of mortality in patients with Deep Vein Thrombosis (DVT) and pulmonary embolism, the aim of this study was to evaluate the role of daily measurement of lower limb circumference in early diagnosis of DVT in patients admitted to Infectious Diseases Ward of Imam Reza Hospital, Mashhad, during 2012-2013.

Materials and Methods: This cross-sectional study was conducted in Infectious Diseases Ward of Imam Reza Hospital of Mashhad, Iran. Patients were divided into two age- and gender-matched groups. In the first group, the difference between the two legs was greater than 1 cm and in the second group it was 3 cm or more. Circumference of the two legs was assessed on a daily basis at 10 cm above tibial tuberosity. Doppler sonography was performed to rule out DVT. Data were analyzed using SPSS, Version 16.

Results: A total of 204 patients were enrolled in this study, 18 of whom (8/8%) were diagnosed with DVT through Doppler sonography. In addition, 17 patients (11/3%) had fever as a comorbidity. Mean difference of the two legs was more than 3 cm in 16 DVT patients (14%), and two patients with mean difference of less than 3 cm had DVT.

Conclusion: Daily measurement of lower limb circumference was an accurate and cost-effective technique for early diagnosis of DVT.

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Introduction

Venous Thromboembolism (VTE), a disease that includes both Deep Vein Thrombosis (DVT) and pulmonary embolism (PE), is the third most common vascular disease after myocardial infarction and ischemic stroke (1). Numerous cases are diagnosed with DVT in emergency department visits and several studies have been conducted to evaluate its risk factors (2).

DVT and PE are two major causes of morbidity and mortality in hospitalized patients. The annual incidence rate of DVT is estimated to be 1.92 per 1000 cases, and it is more frequently observed in males (3). The

probable risk factors for DVT include: malignant diseases, acute infections, advanced age (more than 75 year) and past history of DVT. Therefore, screening and early prevention of DVT has clinical significance.

Recent studies on DVT formation mechanisms have mainly focused on inflammation and the fibrinolytic system and has shown that Interleukin (IL)-17 plays an important role in connecting inflammation to fiber formation/dissolution systems (4).

The clinical picture of DVT has not been thoroughly specified yet, and symptoms such as pain or swelling of limbs are often found in many other diseases. The signs

and symptoms are divided into two groups of DVT- and PE-related manifestations (5). In most cases, the first manifestations of DVT are leg swelling and limb pain and tenderness. A wide range of diagnostic tests may be useful in DVT diagnosis including: clinical assessment, D-dimer, plethysmography, rheography, ultrasound, Computed Tomographic (CT) scanning, Magnetic Resonance Imaging (MRI) and venography. Thus, assessment of the probability of incidence of the disease plays a very important role in correct diagnosis of DVT (6). VTE is the third most common life-threatening cardiovascular disease in the United States (7).

Although increasing lower limb circumference might be the first sign of DVT, most physicians believe that it is not an accurate indicator. Clinical examination of DVT is usually neglected in critically ill patients and DVT is diagnosed when presented as PE complications, which might increase patients' risk of mortality and morbidity (8). Hence, finding a clinical indicator would be very helpful and can facilitate DVT diagnosis. On the other hand, the accuracy of such index is crucial. Lower limb circumference measurement is proposed for early diagnosis of DVT. And in some studies unilateral enlargement of limbs with difference of more than 3 cm was reported to predict DVT (9).

The number of acutely ill hospitalized patients at risk of acute VTE is not known. The aim of this study was to evaluate the accuracy of daily measurement of lower limb circumference for early diagnosis of DVT in patients admitted to Infectious Diseases Ward of Imam Reza Hospital, Mashhad, during 2012-2013.

Materials and Methods

This cross-sectional study was conducted under the supervision of Mashhad University of Medical Sciences during 2012-2013. All the patients admitted to infectious disease unit of our tertiary hospital with the following inclusion criteria were enrolled the study: immobilization, recent surgery, Body Mass Index (BMI) of more than 30, previous history of DVT, trauma, malignancies, Oral Contraceptive Pills (OCP) consumption, pregnancy, stroke, congenital thrombophilia and infectious disease such as osteomyelitis, Cytomegalovirus (CMV) and Tuberculosis (TB). Patients younger than 15 were

excluded. This study was approved by ethical committee of MUMS and a written consent was obtained from the participants.

Lower limb circumference was measured in each patient on a daily basis at 10 cm from tibial tuberosity and if a difference was detected, measurement was repeated with a second researcher. Then, patients were divided into two groups with regard to difference between the two limbs (less than 3 cm and more than 3 cm). Demographic information were recorded in a checklist. Color Doppler ultrasonography was considered as the gold standard test for DVT detection. Finally, data were coded and analyzed performing Chi-square and fisher exact tests, using SPSS Version 16.

Results

A total of 204 patients were enrolled in this study, including 110 male (53.9%) and 94 female (46.1%) patients. The mean age was 57 ± 9 years. Frequency of age groups is shown in Figure 1.

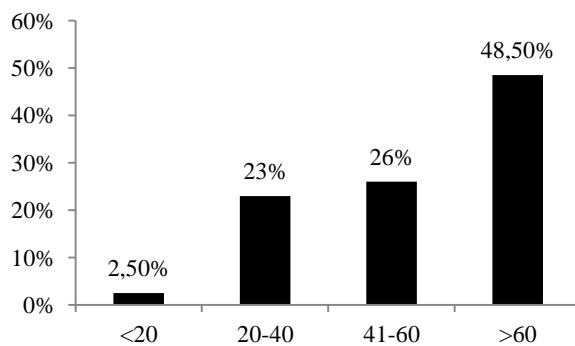


Figure1: Frequency of age group.

Cause of admission for 107 patients (53.2%) was infection and 94 cases (46.8%) were admitted for other reasons. Moreover, DVT in 18 patients (8.8%) was confirmed by Color Doppler ultrasonography. In Table 1 demographic information was compared between the two groups.

Logistic regression revealed a significant relationship between lower limb circumference and DVT occurrence (P -value=0.043). Sensitivity and specificity of lower limb circumference were 88.8 and 42.4%, respectively.

Table1: Comparison of demographic characteristics between two groups

		DVT		P value
		No (n=186)	Yes (n=18)	
Gender	Male	99 (90%)	11 (10%)	0.624
	Female	87 (92.6%)	7 (4.7%)	
Age	Age<40	48 (92.3%)	4 (7.7%)	0.728
	Age >40	138 (90.8%)	14 (9.2%)	
Infection	yes	100 (93.5%)	7 (6.5%)	0.321
	no	84 (88.5%)	11 (11.5%)	
Fever	yes	134 (81.7%)	17 (11.3%)	0.027
	no	52 (98.1%)	1 (1.9%)	
BMI	<30	5 (100%)	0	0.627
	>30	181 (91%)	18 (9%)	
Immobilization	yes	56 (93.3%)	4 (6.7%)	0.595
	no	130 (90.3%)	14 (9.7%)	
Two limbs differences	<3 cm	88 (97.8%)	2 (2.2%)	0.002
	>3 cm	98 (86%)	16 (14%)	
Pulmonary infection	yes	34 (82.9%)	7 (17.1%)	0.156
	no	38 (92.7%)	3 (7.3%)	
Lethargy	yes	78 (94%)	5 (6%)	0.138
	no	108 (89.3%)	13 (10.7%)	
Hemiplegia	yes	40 (87%)	6 (13%)	0.374
	no	146 (92.4%)	12 (7.6%)	
Critically ill	yes	64 (91.4%)	6 (8.6%)	0.575
	no	122 (91%)	12 (9%)	
Recent surgery	yes	50 (90.9%)	5 (9.1%)	0.564
	no	136 (91.6%)	13 (8.7%)	
OCP	yes	13 (100%)	0	0.384
	no	176 (90.6%)	18 (9.4%)	
Malignancies	yes	29 (93.5%)	2 (6.5%)	0.746
	no	157 (90.8%)	16 (9.2%)	
Stroke	yes	45 (88.2%)	6 (11.8%)	0.570
	no	141 (92.2%)	12 (7.8%)	
Pregnancy in the last two years	yes	6 (100%)	0	0.682
	no	181 (92%)	7 (8%)	
Trauma	yes	17 (94.4%)	1 (5.6%)	0.714
	no	169 (90.6%)	17 (9.1%)	
TB	yes	15 (93.8%)	1 (6.2%)	0.672
	no	71 (91%)	17 (9%)	
Addiction	yes	19 (90.5%)	2 (9.5%)	0.906
	no	167 (91.3%)	6 (8.7%)	

Discussion & Conclusion

Several risk factors for incidence of DVT have been investigated, including: smoking, obesity, cancer, immobilization and congestive heart failure. DVT and PE together are labeled VTE, often characterized by severe disability and impairment of quality of life (10).

Each year, 4,000,000 surgical and 8,000,000 medical patients hospitalized in the US are at moderate or high risk for VTE (11). In a global cross-sectional study, 42% of medical and 64% of surgical patients were also at moderate or high risk for VTE. According to Intermountain Healthcare database, the four most important risk factors for VTE among hospitalized medical patients are: (1) previous history of VTE, (2) bed rest, (3) peripherally inserted central venous catheter, and 4) cancer (12). In a population-based study conducted in Norway, the annual incidence rates of all the first VTE, DVT and PE events were 1.43,

0.93 and 0.50 per 1000 cases. Incidence rates increased exponentially with age and were slightly higher in women than men (13).

The 30-day case-fatality rate was 9.7% for PE and 4.6% for DVT, and it was higher in patients with cancer (19.1%) than in patients without cancer (3.6%). In patients without cancer, there was no increased rate of mortality beyond 6 months after the event, as compared to the general population. The mortality rate was 20% lower in women than men (14).

In a study, Barba showed that DVT patients with concomitant fever had a higher rate of mortality (15).

In our study, DVT incidence was higher in patients with fever. It seems that fever might be an indicator for a more severe underlying disease and might be associated with DVT prognosis. In our study, infections were not more common in patients with

DVT. This might be due to various inclusion criteria and sample size. Additionally, we did not evaluate acute and chronic infections. Smeeth revealed that DVT and PE occurred in the first two weeks after urinary tract and respiratory infections, which are transient risk factors for DVT (16). In the present study, respiratory infections were more frequent in DVT patients, but this relationship was not statistically significant. In a previous study in London, Calyton proposed a correlation between DVT and respiratory infections (17).

VTE is a multifactorial disorder which arises as a result of interaction between genetic and environmental factors. Inherited thrombophilia is frequently suspected in patients with VTE at a young age, multiple family members with VTE, idiopathic or recurrent VTE or recurrent spontaneous abortions. Major inherited thrombophilia include factor V Leiden, prothrombin gene mutation 20210 and deficiencies of protein C,

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protein S or antithrombin. Prevalence of inherited thrombophilia varies across different populations (18).

Methicillin resistant *Staphylococcus aureus* (MRSA), HIV (human immunodeficiency virus) and CMV infections, tuberculosis, hypertension, diabetes mellitus and smoking are some probable conditions associated with DVT (19-26). In our study, rate of DVT was not higher in patients with *Staphylococcus aureus* and TB infections. CMV and HIV infections were not observed in our patients.

Our study revealed that lower limb circumference is a reliable and sensitive technique for early diagnosis of DVT in patients with infectious diseases. Our study was of cross-sectional design; therefore, our findings were not compared with those of a control group, which was a big limitation.

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