

# Comparative Assessment of the Incidence of Unilateral and Bilateral Lower Limb Deep Venous Thrombosis in Symptomatic and Clinically Suspected Patients

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## Abstract

**Objective:** Deep vein thrombosis (DVT) is a familiar coagulation pathology that can be diagnosed through Doppler ultrasonography. This is a highly specific and sensitive method for the assessment of thrombosis. The present study aims to assess the incidence of lower limb DVT in a cohort of symptomatic and clinically suspected Saudi Arabian patients.

**Methods:** This is a retrospective study that incorporated 1051 DVT patients over three years between January 2015 and December 2017 which presented with signs and symptoms of single or bilateral disease. Data were collected on the history of oedema, swelling, pain, tenderness, weakness, hotness, redness, fever, and vomiting. Possible risk factors that may increase the probability of developing DVT were also recorded.

**Results:** The incidence of bilateral lower limb DVT in suspected patients was 84.5% negative and 15.5% positive. Old age was found to be the most common risk factor that resulted in DVT. The incidence of DVT is more common among females, whereas males were with all the bilateral cases.

**Conclusions:** Screening tests are needed for DVT in symptomatic and asymptomatic patients.

**Keywords:** Incidence, lower extremity, risk factors, ultrasonography, venous thrombosis.

## Introduction

Deep venous thrombosis (DVT) is a medical disease that presents with the formation of a thrombus within a deep vein, predominantly in the lower limbs.<sup>1</sup> DVT is potentially life-threatening as it can result in pulmonary embolism (PE). A National Institute of Health consensus conference has reported that DVT is the cause of 50,000 morbidities from PE and 450,000 hospitalizations annually.<sup>2</sup> PE occurs when the blood clots dislodge from a deep vein and affect the pulmonary arteries; there is an increased mortality rate of 15 per cent in the three months after diagnosis.<sup>3</sup>

De Maeseneer et al.<sup>4</sup> have highlighted that recent DVT guidelines show significant post-thrombotic morbidity. A high incidence of DVT has been recorded among hospitalized and bedridden patients.<sup>1</sup> Lower limb DVT is the most common form of venous thrombosis, with an incidence of 1 per 1000 adults annually.<sup>5</sup> The annual incidence rate of DVT is estimated to be 5 per 10,000 individuals.<sup>6</sup> DVT can be asymptomatic or symptomatic, however, when it is symptomatic, it is presented with the following clinical symptoms: pain, oedema, tenderness, weakness, swelling, redness, and warmth.<sup>1</sup> People at risk of DVT are the aged, those having undergone major surgery, trauma, or pregnancy, and those with prolonged immobilization or use of oral contraceptives.<sup>1</sup>

Min et al.<sup>7</sup> note that despite its detrimental impact, more than 50 per cent of DVT patients lack signs and symptoms and that DVT diagnosis on clinical signs and symptoms is often highly inaccurate because DVT signs and symptoms are non-specific and often linked to other lower extremity disorders, such as post-thrombotic syndrome, lymphedema, cellulitis, superficial

venous thrombosis, musculoskeletal trauma, and Baker's cysts. Oudega et al.<sup>8</sup> showed that generally no signs or symptoms possess enough sensitivity and specificity alone or in combination for accurate diagnosis or exclusion of thrombosis. Thus, prompt objective testing is necessary to confirm the diagnosis and enable safe and effective therapy. Several different strategies are being developed for improving the diagnostic accuracy of DVT and minimizing misdiagnosis or overtreatment.

Following the imaging studies and sequential testing, an assessment of clinical pretest probability with a D-dimer test using a structured scoring system is involved in the diagnostic assessment of DVT.<sup>9</sup> Some previous studies have shown an increased DVT incidence for inpatients presenting with unilateral signs and symptoms that were distinguished through phlebography.<sup>10,11</sup> However, phlebography is rarely applied in clinical practice because of logistics issues, the risk of complications, and its high cost.

Doppler ultrasonography (US) is another important diagnostic tool for examining patients with suspected DVT, which incorporates a highly sensitive and specific test procedure for diagnosing DVT in symptomatic and asymptomatic patients.<sup>12</sup> Compared to clinical examination, the use of Doppler US provides a higher rate of accuracy in the diagnosis of lower limb DVT. Investigations concerning the incidence of bilateral DVT among patients with single asymptomatic limbs are likely to be restarted based on the advantages provided by the Doppler technique.<sup>11</sup> Significant alterations have been observed in the diagnosis and treatment of DVT following the advent of Doppler US. This technique uses the Doppler ultrasound instrument to generate images that detect distortion in the venous blood flow

pattern through a thrombotic obstruction.<sup>13</sup> It is a successful screening modality to ensure early diagnosis and proper treatment for high-risk patients. The primary focus of DVT research has been on risk factors and prevalence, with a paucity of studies concerning diagnosis. Thus, the present study sets out to assess the incidence of lower limb DVT in symptomatic and clinically suspected patients in Saudi Arabia using Doppler US.

## Materials and Methods

A retrospective study design was incorporated to analyze the incidence of lower limb DVT in symptomatic and clinically suspected patients (who have one or more of the clinical presentations and one or more abnormalities from different diagnostic categories), using Doppler US. All medical records at a University Hospital in Jeddah, Saudi Arabia were reviewed from January 2015 to December 2017 in which venous Doppler imaging was used. The study incorporated the records of 1501 (male 344, female) Saudi Arabian adult patients with clinical suspicion of DVT and symptomatic DVT. The patients who were diagnosed with DVT either through B-mode or on colour Doppler US were included. Whereas, pediatric and neoplastic cases were excluded. Patients above 70 years of age were considered elderly.

The DVT cases were analyzed with regards to their age sex, and days of hospitalization. The patients were examined in a supine position at about 15 or 20 degrees for adequate distention of the venous system among the patients. This helps in observing the iliac veins in the case of abnormal Doppler signals with obstruction at the level of the groin. A history of oedema, swelling, pain, tenderness, weakness, hotness, and redness among the patients was also recorded. Moreover, factors increasing the risk of DVT were also monitored. The Statistical Package for the Social Sciences (SPSS), version 20.0, was used to analyze patient records. Descriptive statistics were used in the analysis of the data.

An ethical approval was obtained from the Institutional Review Board approval of was obtained from King Abdul-Aziz University Hospital in Jeddah, Saudi Arabia having bearing number 384–23

## Results

Most of the bilateral DVT study patients were inpatients (only 5 were outpatients). Bilaterally positive cases concerned patients above 70 years of age. Unexpectedly, all patients were male and were diagnosed between the 5<sup>th</sup> and 9<sup>th</sup> days following admission. The incidence rate of lower limb DVT among suspected patients was 84.5% negative and 15.5% positive. Of all DVT patients, 37 were bilateral (3%), 581 were left-sided (48%), and 583 were right-sided (49%)

The number of bilateral cases diagnosed with DVT was 4 (11%). Ninety-six (53%) DVT cases occurred on the left side and 86 (47%) occurred on the right side. Thirty-one cases (89%) were negative bilateral cases. One hundred and eighty-six cases were positive unilateral, whereas 1015 (85%) were negative patients

The risk factors monitored in DVT patients are shown in Table 1. The results show that old age (70 years of age or above) was the most common risk factor for DVT (38.8%), followed by diabetes mellitus (14.8%). In the study, patient screening was performed by the ultrasound technicians. Table 2 shows the relative effectiveness concerning patient

screening by performing crosstabulation. The relative effectiveness is 10.8% for bilateral cases, 16.5% for the left side, and 14.7% for the right side.

Table 3 found the association between DVT and gender by using the chi-square test. It was found that gender was

Table 1. Risk factors increasing the probability of developing DVT

| Risk Factor        | Frequency | Percentage |
|--------------------|-----------|------------|
| Elderly            | 283       | 38.8       |
| DM, HTN            | 108       | 14.8       |
| Bed ridden         | 57        | 7.8        |
| DM                 | 46        | 6.3        |
| Pregnant           | 36        | 4.9        |
| HTN                | 29        | 4.0        |
| DM, HTN, Bedridden | 28        | 3.8        |
| DM, HTN, IHD       | 24        | 3.3        |
| DM, HTN, HF        | 15        | 2.1        |
| Breast cancer      | 12        | 1.6        |
| HF                 | 8         | 1.1        |
| Obese              | 8         | 1.1        |
| IHD                | 7         | 1.0        |
| Other              | 69        | 9.5        |
| Missing Values     | 471       |            |

Elderly = 70 years of age or above, DM = Diabetes mellites, HTN = Hypertension, HF = Heart Failure, IHD = Ischemic Heart Diseases, Bedridden = confined to bed due to a disease or old age, Obese = BMI (Body mass Index) > 30

Table 2: Effectiveness of examining the lower limbs in case of a clot

|  | Injury                           |          |       | Relative Effectiveness |
|--|----------------------------------|----------|-------|------------------------|
|  | Results of the screening from US |          |       |                        |
|  | Negative                         | Positive | Total |                        |
| Bilateral                              | 33                               | 4        | 37    | 10.8%                  |
| Left                                   | 485                              | 96       | 581   | 16.5%                  |
| Right                                  | 497                              | 86       | 583   | 14.7%                  |
| Total Effectiveness of the Examination | 1015                             | 186      | 1367  | 13.6%                  |

Table 3: Association of DVT type with gender

| Type of DVT | Gender     |           | Chi Square P value (X <sup>2</sup> , Df) |
|-------------|------------|-----------|--|
|             | Male       | Female    |  |
|             | N (%)      | N (%)     | .030 (7.019, 2)                          |
| Bilateral   | 4 (4.8)    | 0 (0%)    |  |
| Left        | 37 (44.6%) | 59 (57.3) |  |
| Right       | 42 (50.6)  | 44 (42.7) |  |
| (total)     | 83         | 103       |  |

Table 4: Symptomatic presentation of Lower Limb DVT

| Symptomatic presentation | Numbers | Ratio % | Sound   |        | DVT     |       |
|--------------------------|---------|---------|---------|--------|---------|-------|
|                          |         |         | Numbers | %      | Numbers | %     |
| Elderly                  | 418     | 34.8%   | 339     | 81.1%  | 79      | 18.9% |
| DM                       | 220     | 18.3%   | 188     | 85.5%  | 32      | 14.5% |
| HTN                      | 195     | 16.2%   | 169     | 86.7%  | 26      | 13.3% |
| Bed ridden               | 73      | 6.1%    | 60      | 82.2%  | 13      | 17.8% |
| IHD                      | 41      | 3.4%    | 36      | 87.8%  | 5       | 12.2% |
| Breast Cancer            | 39      | 3.2%    | 31      | 79.5%  | 8       | 20.5% |
| Pregnant                 | 39      | 3.2%    | 37      | 94.9%  | 2       | 5.1%  |
| HF                       | 12      | 1.0%    | 12      | 100.0% | 0       | 0     |
| Obese                    | 10      | 0.8%    | 9       | 90.0%  | 1       | 10.0% |
| Other                    | 518     | 43.1%   | 446     | 86.1%  | 72      | 13.9% |

DM = Diabetes mellitus, HTN = Hypertension, HF = Heart Failure, IHD = Ischemic Heart Diseases, Bedridden = confined to bed due to a disease or old age, Obese = BMI (Body mass Index) > 30

Table 5: Relationship of DVT with type of hospital admission

| Type of hospital admission |     |   | DVT      |          | Chi square test<br>P value<br>(X <sup>2</sup> , Df) |
|----------------------------|-----|---|----------|----------|---|
|                            |     |   | negative | positive |   |
| patient                    | ER  | N | 373      | 94       | 0.002<br>(12.725, 2)                                |
|                            |     | % | 79.9%    | 20.1%    |   |
|                            | IN  | N | 555      | 81       |   |
|                            |     | % | 87.3%    | 12.7%    |   |
|                            | OUT | N | 87       | 11       |   |
|                            |     | % | 88.8%    | 11.2%    |   |

ER = Emergency Room, IN = inpatient, OUT = Outpatient

significantly associated ( $P$ -value = .030,  $X^2 = 7.019$ ,  $Df = 2$ ) with gender, with females (103, 55.4%) having a higher incident rate than males (44.6%). All 4 bilateral cases were male. Whereas females had no bilateral case. Females had more cases in the left leg (57.3%), and the male had more in the right (50.6%).

Table 4 shows the different symptomatic symptoms of DVT, with most of the patients having diabetes (220).

Table 5 shows that there was a significant association between types of hospital admission and DVT ( $P$ -value = .002,  $X^2 = 12.725$ ,  $Df = 2$ ). The majority of the positive cases i.e., 20.1% (94) were in patients getting admitted to the emergency room (ER).

## Discussion

The present study has explored the effectiveness of the diagnosis of DVT using Doppler US. The patients were examined for any previous history or presence of any risk factor of DVT. The study found an incidence of 15.5% among all symptomatic cases. Females were found to have a higher incidence rate than males. The majority of the positive cases were diagnosed on the 2<sup>nd</sup> day of hospital admission. The diagnosis was done using Doppler US.

While the technique of duplex ultrasound has shown specificity and sensitivity of 98% and 95%, respectively, for

diagnosing DVT among symptomatic patients in one study,<sup>14</sup> Doppler US has been highly recommended for detecting thrombus propagation into the popliteal vein (proximal) for isolated calf vein thrombosis,<sup>15</sup> which is consistent with Haurani et al.<sup>16</sup> and Eze et al.<sup>17</sup> As this was retrospective study, all the cases had Doppler US as per availability in hospital. In these studies<sup>13-17</sup> patients with unilateral leg swelling suffered from DVT. However, only a small percentage of patients suffering from asymptomatic DVT were found.<sup>13-17</sup> Many of the DVT patients who were asymptomatic showed an increase in venous volume and pressure, causing oedema.<sup>13</sup> Indeed, oedema was the most common sign observed in patients suffering from DVT.<sup>13</sup>

Other medical conditions that are linked as risk factors of DVT were uncovered in the present study, which includes old age, diabetes mellitus, confinement to bed (patients with prolonged immobilization for  $\geq 12$  h postadmission to ICU and Ventilation  $\geq 12$  h),<sup>1</sup> breast cancer, pregnancy, and obesity. A similar retrospective study to the present study has concluded that other major risk factors for DVT are malignant neoplasm, surgery, long hospital stay, trauma, and chemotherapy.<sup>11,18</sup> A study by Lee et al.<sup>10</sup> investigated the prevalence and outcome of DVT among patients suffering from a pulmonary embolism. The results showed a prevalence rate of 45.5% of DVT for patients, although there was no significant relationship between DVT and the development of pulmonary embolism in the recruited participants.

Le Gal et al.<sup>18</sup> assessed patients with suspected bilateral leg DVT. Similarly, in this study as per protocol, the patients with detection in one limb were imaged for the other limb as well mostly by the same operator. According to a study, asymptomatic patients with DVT are likely to have a previous history of venous thromboembolism.<sup>18</sup> Therefore, patients with symptomatic cases in a unilateral limb may have asymptomatic cases in another limb. However, further research is needed to find the association of asymptomatic cases, as this study was limited only to symptomatic ones.

The study findings recommend that DVT analysis through radiographic imaging is important in detecting the clinical outcomes of patients and assisting in forming appropriate treatment decisions. It supports the view that

individuals of increasing age when admitted to the hospital or have any symptoms of DVT must get ultrasound tests for detection. Ultrasound testing is also important to examine the extent, site, and stage determination of thrombus. However, the limitation of the study is that the site and stage was not traced as not all patient's record had it noted. In addition, thrombophilia screening should be routinely carried out on elderly, diabetic, hypertensive, and cancer patients, along with those with other risk factors. Understanding the common risk factors and their contribution to the development of DVT is integral in the prevention of adverse health complications.

## Conclusion

This study has shown that the incidence of lower limb DVT in clinically suspected patients is high, therefore, any patient with a symptom should have been radiographically tested. It can also be concluded that despite females being more

affected by it, males had more severity of the case as most of the bilateral cases were significantly found in males. It also showed that half of the patients who were positive on both legs were highly associated with old age. The screening results are likely to significantly reduce the time spent by medical practitioners and faculties in the diagnosis of DVT. Future studies could perform larger-scale sampling to consider a wider range of risk factors of DVT and the stage site of thrombosis.

## Conflicts of Interest Disclosure

The author declares no conflict of interests.

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