COMPARATIVE COLOUR DOPPLER STUDY OF LOWER LIMB DEEP VENOUS THROMBOSIS IN DIABETIC AND NON DIABETIC PATIENTS WITH REVIEW OF CURRENT KNOWLEDGE

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ABSTRACT Introduction: The present study compared the clinical characteristics of DVT patients with and without DM. The risk of venous thromboembolism appears to be elevated in type 1 and type 2 diabetic patients. In addition, Hyperinsulinemia, which is often present in type 2 diabetes, has also been shown to have a prothrombotic effect. Doppler ultrasonography is a reliable, non-invasive and rapid investigation to detect DVT. Therefore helping in the early detection of DVT in clinically suspected patients. On USG, findings in favour of DVT are non-compressible venous segment with loss of phasic flow on Valsalva, shows absent colour flow if completely occlusive and lack of flow augmentation with calf squeeze and increased flow in superficial veins. Objectives: To Assess and analyze the colour Doppler findings and to evaluate site, extent and stage of lower limb deep vein thrombosis of lower limb deep vein thrombosis in diabetic as well as non-diabetic patients. Methods: Present observational comparative study was conducted in the Department of Radio-diagnosis of tertiary level care. Results: A total of 36 patients were enrolled in this study 21 were diabetic, and 15 were non-diabetic. The incidence of DVT was found to be 21% among people with diabetes and 15% among non-diabetics. Conclusion: Incidence of deep vein thrombosis in diabetic and non-diabetic patients differs. However, it is not statistically significant. Anatomic localization of the thrombus revealed that common iliac, external iliac, common femoral, femoral and popliteal vein involvement was more common among people with diabetes as compared to non-diabetics.

KEYWORDS Diabetes mellitus, Non-diabetes mellitus, Deep vein thrombosis, venous thromboembolism

List of abbreviations

| Abbreviation | Description |
|--------------|-------------|
| DVT          | Deep vein thrombosis |
| PE           | Pulmonary embolism |
| VTE          | Venous thromboembolism |
| DM           | Diabetes mellitus |

Introduction

Deep vein thrombosis is a common clinical problem. The patient presents with swelling in the affected leg and a feeling of warmth in the affected leg. Venous ultrasonography is recognized as an accurate and cost-effective method for determining the presence of symptomatic deep vein thrombosis in lower extremities. The present study was aimed at comparing the clinical characteristics of DVT patients with and without DM. Venous thromboembolism shares many risk factors with atherosclerotic cardiovascular disease, including obesity, hypertension, dyslipidemia, smoking, and diabetes. Diabetes mellitus (DM) has reached pandemic proportions globally, and the burden is especially high in India. It is known that diabetes can contribute to
an increase in cardiovascular events. The risk of venous thromboembolism appears to be elevated in both type 1 and type 2 diabetic patients. A 2-fold increase in the age-adjusted risk of venous thromboembolism in patients with diabetes identifies the diabetic population as particularly vulnerable to initial venous thromboembolism and disease recurrence. The majority of epidemiological studies demonstrate an increased risk of deep vein thrombosis and pulmonary embolism among diabetic patients. Virchow proposed venous stasis, increased blood coagulability, and damage to the vessel wall as three precipitants for venous thrombosis. Hyperinsulinaemia, which is often present in type 2 diabetes, has also been shown to have a prothrombotic effect. Increased thrombin generation and higher concentration of procoagulant cell-derived circulating microparticles in patients with type 2 diabetes suggest that hypercoagulability may play an important pathogenic role in the increased frequency of venous thromboembolism. The increased rate of immobility and other medical comorbidities, such as heart failure, chronic lung disease, ischemic heart disease, and chronic kidney disease, results in a persistently elevated risk of recurrent venous thromboembolism after treatment of the initial event.

Aim & Objectives

We compared the incidence and colour Doppler findings of lower limb deep vein thrombosis in diabetic and non-diabetic patients. We also assessed and analyzed the colour Doppler findings of lower limb deep vein thrombosis in diabetic as well as non-diabetic patients. We used grey scale, colour Doppler, and power Doppler to evaluate the site, extent and stage of lower limb deep vein thrombosis and compare these colour Doppler findings in diabetic and non-diabetic patients. Special manoeuvres like compressibility, augmentation and Valsalva were used while confirming the diagnosis of thrombosis.

Material & Methods

The present observational comparative study was conducted in the Department of Radiodiagnosis of tertiary level care. All of these patients explained the purpose of the study and informed written consent was obtained before they were enrolled. The Institutional Ethics Committee approved the study. USG was performed by 7-12 MHz probe with department ultrasonography machine on B-mode and colour Doppler mode.

Results

General features: Non-compressible venous segment with loss of phasic flow on Valsalva, shows absent colur flow if completely occlusive and lacks flow augmentation with calf squeeze and increased flow in superficial veins.

Acute thrombus: Increased venous diameter with soft or deformable intraluminal material and smooth surface.

Chronic post-thrombotic change: Normal or decreased venous diameter, rigid intraluminal material, irregular surface and synechiae or bands.

Discussion

The present study compared the clinical spectrum of DVT patients with and without diabetes. The incidence of DVT was found to be 21% among people with diabetes and 15% among non-diabetics. Descriptive images and findings of people with diabetes are displayed in Fig.1 & 2, and for non-diabetics in Fig.3, 4 & 5. The two groups were similar concerning stage, extent and location of thrombus (Table 1). Previous studies have demonstrated a 1.4-fold increase in the VTE risk in patients with diabetes. The causative nature of this association remains undetermined, as most of the studies are of observational design. A recent meta-analysis found that the association of VTE and DM was no longer significant when adjusted for comorbid conditions. Therefore, the observed association between diabetes and VTE appears to be mainly explained by diabetes-associated comorbid conditions. We found that the most common age group among DVT patients was 50 to 70 years of age and had predominantly male patients could be due to significantly high levels of homocysteine (thrombophilia marker) in males as compared to females as reported in an Indian study. Anatomic localization of the thrombus revealed that common iliac, external iliac, common femoral, femoral and popliteal vein involvement was more common among diabetics as compared to non-diabetics (Table 2). Great saphenous vein (superficial vein) involvement was also found to be significantly more common among people with diabetes as compared to non-diabetics (n = 8/21 vs 1/15; p-value <0.05). Left lower limb was most commonly involved in our patients; similar findings were reported in previous studies demonstrated by Naqvi et al. The pain was found to be more common among non-DM patients in our study as compared to DM; similar results were reported by Piazza et al. Possible reasons could be due to the peripheral neuropathy component of DM. However, oedema was seen similarly among all patients (Table 3). There are a few limitations to our study. First, although Doppler ultrasonography is a non-invasive procedure and provides good accuracy for detecting DVT, the gold standard for detecting DVT is bilateral venography, which was not used in the present study. Second, the diagnosis of DVT can be affected by the level of expertise and years of experience of the sonologist. Therefore, the present results might not apply to other imaging centres. Second, data on numerous factors which might affect the incidence and severity of DVT like BMI, serum triglycerides and co-morbidities were not collected and analysed. Last, we did not analyse type-1 diabetes and type-2 diabetes separately due to the small sample size, although they can have different influences on venous thrombosis.
### Table 1: Comparison and disease distribution of deep venous thrombosis

| Variables                  | Diabetes mellitus (n=21) | Non-diabetes mellitus (n=15) | p value |
|----------------------------|--------------------------|------------------------------|---------|
| **AGE GROUP (IN YEARS)**   |                          |                              |         |
| ≤30                        | 1                        | 0                            |         |
| >30 to 50                  | 6                        | 6                            | 0.88    |
| >50 to 70                  | 11                       | 5                            |         |
| >70                        | 3                        | 4                            |         |
| **GENDER**                 |                          |                              |         |
| Females                    | 6                        | 4                            | 0.99    |
| Male                       | 15                       | 11                           |         |
| **STAGE OF THROMBUS**      |                          |                              |         |
| Acute                      | 6                        | 4                            |         |
| Sub-acute                  | 5                        | 3                            | 0.89    |
| Chronic                    | 10                       | 8                            |         |
| **EXTENT OF THROMBUS**     |                          |                              |         |
| Partial                    | 7                        | 4                            | 0.75    |
| Complete                   | 14                       | 11                           |         |
| **LOCATION OF THROMBUS**   |                          |                              |         |
| Proximal                   | 10                       | 7                            |         |
| Distal                     | 3                        | 5                            | 0.94    |
| Both proximal & distal    | 8                        | 4                            |         |
| **LIMBS INVOLVED**         |                          |                              |         |
| Single right               | 5                        | 5                            |         |
| Single left                | 15                       | 9                            | 0.18    |
| Bilateral                  | 1                        | 1                            |         |

### Table 2: Distribution of patients according to the veins involved

| Veins               | Diabetes mellitus (n=21) | Non-diabetes mellitus (n=15) | p value |
|---------------------|--------------------------|------------------------------|---------|
| Common ileac        | 10                       | 2                            | <0.05   |
| External ileac      | 8                        | 1                            | <0.05   |
| Common femoral      | 17                       | 6                            | <0.05   |
| Femoral             | 15                       | 5                            | <0.05   |
| Popliteal           | 18                       | 9                            | <0.05   |
| Posterior tibial    | 11                       | 8                            | 0.76    |
| Anterior tibial     | 8                        | 7                            | 0.52    |
| Peronal             | 4                        | 2                            | 0.41    |

### Table 3: Distribution of patients according to their complications

| Complications    | Diabetes mellitus (n=21) | Non-diabetes mellitus (n=15) | p value |
|------------------|--------------------------|------------------------------|---------|
| Pain             | 5                        | 12                           | <0.05   |
| Edema            | 8                        | 9                            | 0.22    |
Figure 2 Longitudinal colour mode image showing anechoic thrombus in the common femoral vein, completely occluding it with an associated increase in luminal calibre. Suggests complete acute thrombosis in a diabetic patient. Conversely, longitudinal colour mode image showing no flow in popliteal vein and mildly echogenic lumen causing a slight increase in vein diameter as compared to accompanying artery suggests sub acute complete thrombosis in a diabetic patient.

Figure 3 Transverse colour mode image showing complete thrombosis of common femoral vein, accompanying common femoral artery shows normal flow in a non-diabetic patient. Transverse colour mode image showing complete thrombosis of common iliac vein, accompanying common femoral artery shows normal flow in a non-diabetic patient.

Conclusion

Incidence of deep vein thrombosis in diabetic and non-diabetic patients differs. However, it is not statistically significant. Anatomic localization of the thrombus revealed that common iliac vein, common femoral, femoral vein and popliteal vein involvement were more common among people with diabetes as compared to non-diabetics. Distal veins like anterior tibial, posterior tibial, and peroneal veins involvement were almost similar in DM and non-DM patients. There is no significant mean age difference between diabetic and non-diabetics in the onset of DVT.

Symptoms like pain were significantly more in non-diabetics as compared to a person with diabetes.

Doppler ultrasonography is a reliable, non-invasive and rapid investigation to detect DVT. Therefore early detection of DVT in clinically suspected patients. In addition, an accurate anatomic description of the thrombus, which includes the extent and location of the thrombus, can help the clinician evaluate the course of thrombosis and optimize treatment.

Figure 4 Longitudinal colour mode image showing echogenic partially occluding thrombus of the great saphenous vein in a non-diabetic patient. Transverse colour mode image showing complete absent flow with the anechoic lumen of great saphenous vein suggestive of completely occluding acute thrombus of the great saphenous vein in a non-diabetic patient.

Figure 5 Longitudinal colour mode image showing partial absent flow in lumen of posterior tibial vein suggestive of partial occluding thrombus in a non–diabetic patient. Longitudinal colour mode image showing partial absent flow in lumen of posterior tibial vein suggestive of partial occluding thrombus in a non–diabetic patient.

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Conflict of interest

There are no conflicts of interest to declare by any of the authors of this study.

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