

The Risk Factors and Associated Socio-Demographic Profile of Deep Vein Thrombosis (Dvt) Among Patients Referred For Doppler Ultrasound Imaging At Dr George Mukhari Academic Hospital

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ABSTRACT

Background: Venous Thromboembolism (VTE) is one of the leading causes of cardiovascular related deaths and is a significant economic burden on the healthcare system. Early identification and correct management of patients at risk of developing DVT improves their health.

Objectives: The study sought to determine the risk factors and socio-demographic profiles of Deep Vein Thrombosis (DVT) of patients referred for Doppler ultrasound imaging at Dr George Mukhari Academic Hospital (DGMAH).

Methods: A cross sectional descriptive study was used to determine the risk factors and associated demographic profiles of DVT among patients referred for Doppler ultrasound imaging at DGMAH. The study used quantitative methods. A total of 135 patients participated. Patients completed a structured questionnaire to assess risk factors of DVT. They were then assessed for DVT using an ultrasound scan and results were documented. The information from the questionnaires and results was coded and entered into a computer using Statistical Package for Social Science (SPSS) Version 25. Data analysis was then conducted.

Results: Of the 135 patients who were referred to the radiology department for ultrasound scanning of lower limbs between January and June 2019, 42 patients (31%) were diagnosed with DVT. Prolonged bed rest ($p=0.037$) and history of having recently completed TB treatment ($p=0.042$) were associated with development of DVT.

Conclusion: Prolonged immobility and recent completion of TB treatment were associated with increased risk of developing DVT. There is need to screen these patients for DVT early and institute DVT protocols.

Keywords: DVT; Risk factors; Dr George Mukhari Academic hospital; Thrombosis; Prophylaxis

INTRODUCTION

Venous Thromboembolism is the third leading cause of cardiovascular related deaths and is a significant economic burden on the healthcare system [1] Venous thromboembolism although preventable, still causes significant morbidity and mortality among hospitalized patients [2]. Early identification and correct management of patients at risk of developing deep vein thrombosis improves their health.

The study sought to determine the risk factors and socio-demographic profiles of patients diagnosed with lower limb DVT at Dr George Mukhari Academic Hospital (DGMAH). The results of the study would be used to identify patients at risk of developing DVT and initiate prophylaxis before they develop the condition.

The study would add to the body of knowledge on the risk factors for developing DVT in the South African context.

VTE comprises DVT and Pulmonary Embolism (PE). Deep vein thrombosis refers to the formation of thrombi within the venous system of the lower limbs, whereas PE occurs when a thrombus dislodges and partially or completely blocks a pulmonary artery or one of its branches. PE is a life threatening complication of DVT [3].

The prevalence of VTE varies between countries. In the USA, Europe and Asia, the prevalence of VTE was found to range from 0.2 to 0.66%, with lower rates in Asia compared to Western countries [4]. This changed in 2011 when the prevalence of DVT suddenly increased to 2.20% in Japan Tsunami flooded shelters

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Received: January 19, 2021, **Accepted:** February 02, 2021, **Published:** February 09, 2021

Citation: Kamombe-Zingwari H, Kisansa M, Dehghan-Dehnavi A (2021) The Risk Factors and Associated Socio-Demographic Profile of Deep Vein Thrombosis (Dvt) Among Patients Referred For Doppler Ultrasound Imaging At Dr George Mukhari Academic Hospital. J Vasc Med Surg. S4: 001.

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[5]. This was attributed to dehydration and restricted mobility in crowded shelters.

Although there is limited information on DVT prevalence in Africa, a systemic review by Danwang et al. [6] showed a higher prevalence of DVT among post-operative patients, varying from 2.4% to 9.6%. A study done in a teaching hospital in Lusaka, Zambia showed a very high prevalence of lower limb DVT of 11% among HIV positive patients [7]. In South Africa, an estimated 2,00,000 people develop DVT annually and thromboembolic disease is responsible for 20,000 deaths per annum [8]. Dr George Mukhari Academic Hospital has protocols on the use of prophylaxis for DVT to reduce incidence of the disease among hospitalised patients. The use of prophylaxis in hospitalised patients reduces the incidence of DVT [9].

Virchow's triad describes three factors that contribute to thrombosis, and these are; venous stasis, endothelial injury and hypercoagulability [10]. These should be targeted when considering the prevention of deep vein thrombosis.

In hypercoagulability, the changes in blood coagulation pathways increases the risk of coagulation [11]. Hypercoagulable instances can be due to hereditary factors such as Factor V Leiden, Protein C and S deficiency and acquired factors such as cancer, oral contraceptives, hormone replacement therapy, inflammatory bowel disease, HIV, nephrotic syndrome and pregnancy [12].

Normal endothelium is antithrombotic while endothelium injury triggers clot formation [11]. The risk of post-operative DVT is higher than preoperative, both in the injured and uninjured limbs in patients with hip fractures [13]. This is secondary to blood loss and vessel injury during surgery.

Venous stasis can occur due to immobility, congestive cardiac failure and polycythaemia [10]. Prolonged immobility was a risk factor for DVT in HIV positive patients attending out patients department at Mulago hospital in Uganda [14]. The major complications of deep vein thrombosis include pulmonary embolism, post thrombotic syndrome, recurrent DVT and treatment related complications.

MATERIALS AND METHODS

We carried out a cross sectional descriptive study. The study used quantitative methods to assess the association between named risk factors and DVT among patients referred for Doppler ultrasound imaging.

The study assessed patients referred for Doppler ultrasound imaging at DGMAH for a period of 6 months.

Inclusion criteria

All patients aged ≥ 18 years and those below 18 years with consent, referred for Doppler ultrasound imaging were included in the study.

Exclusion criteria

Patients currently diagnosed with DVT and below 18 years, without consent, were excluded from the study.

Sample size was calculated using a Pearson Chi square test based on the information that an average of 20 patients is referred for

ultrasound every month. Prediction based on medium effect size of 0.3 [15] and power of 0.8 [16] with degrees of freedom of 3, an adequate sample size was 122.

All patients referred for Doppler ultrasound imaging during the study period were given a detailed explanation on the purpose of the study. They were given a consent form to sign. Ethical clearance to perform the study was obtained from Sefako Makgatho University Research Ethics Committee (SMUREC). A structured questionnaire to assess risk factors of DVT, which included demographic data and DVT risk factors, was then administered.

The patient was then examined for DVT using the protocol below.

Ultrasound protocol

- A Philips Ultrasound machine EPIQ5G was used for the study. Linear probe: 5-10 MHz and Curvilinear probe: 3-5MHz was also used.
- Gray scale, colour Doppler and phasic flow were demonstrated.
- All patients were examined in supine position.

Procedure: Starting at the common femoral vein, direct visualisation of the vein for hyperechoic material and graded compression was done. Graded compression was done by applying pressure perpendicular to vessel. In the absence of a thrombus the vessel was compressed to a white thin line. Colour Doppler was used to demonstrate flow and spectral Doppler changes.

A convex probe was used to interrogate the pelvis. Colour Doppler and phasic flow were used to evaluate external iliac veins and Inferior Vena Cava (IVC).

Information from the questionnaires was entered into a computer using Statistical Package for Social Science Version 25. All the inferential statistics were conducted at 95% confidence interval with a $p < 0.05$.

RESULTS

Biographic profile of the respondents

Gender: Most participants were females, who constituted 76% ($n=103$) and 24% ($n=32$) were males as shown in Figure 1.

Age: The ages of the study participants are as shown below. More than 50% of the participants were below 50 years (Figure 2).

Descriptive statistics of current medical history

Twenty-four (18.3%) patients were bedridden for more than three

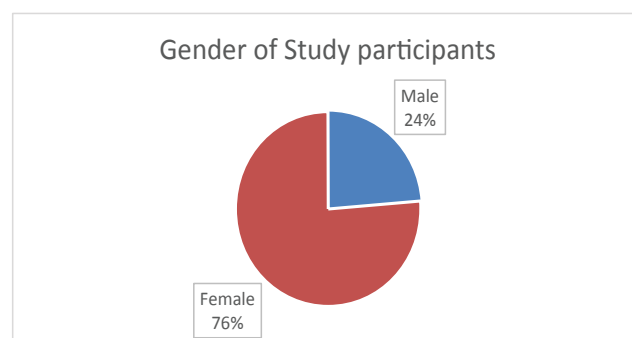


Figure 1: Biographic profile of gender.

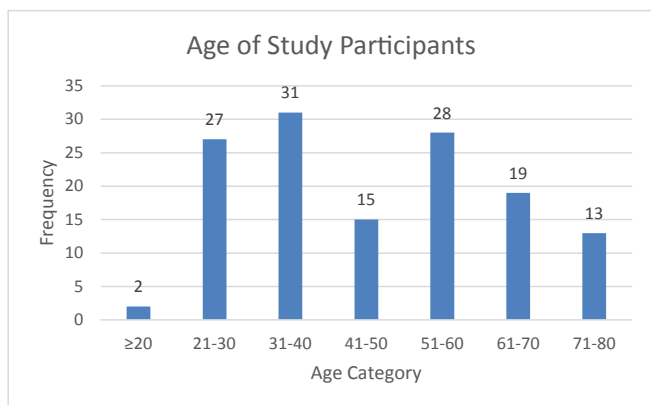


Figure 2: Biographic profile of age.

days. Nine patients (6.9%) had undergone surgery within four weeks prior to the study. Majority of patients did not have recent paralysis or plaster immobilisation of the lower extremities.

There were 40 HIV positive patients (30.5%), while 91 patients (69.5%) were HIV negative.

Seven (5.3%) patients were diagnosed with TB at the time of the study and six patients (4.7%) had just completed TB treatment. Most of the patients (87%) had no history of cancer as shown in Figure 3.

Assessment of the current obstetric, drug and social history showed that few patients were smokers n=10 (7.5%), on oral contraceptives n=5 (5%) and on hormone replacement therapy (n=5) 3.8%. Obesity was defined as a waist circumference of more than 102 cm in males and more than 88 cm in females. Only n=39 (30.5%) of the patients were obese. Few patients n=16 (16.5%) were pregnant. A total of 6.3% (n=6) patients had delivered within the previous 6 weeks as shown in Figures 4 and 5.

Descriptive statistics for past medical history

A total of 18 (13.3%) patients had a previous history of DVT and 6 (4.5%) of the 133 patients had a history of having a central venous line inserted in the limb where DVT was being investigated.

Few patients n=12 (8.9%) had a history of varicose veins. Only three patients (2.2%) had a history of clotting disorders (thrombophilia) and n=10 (7.6%) had history of heart attack or stroke.

The association between current history and DVT diagnosis

Statistical analysis of the results indicated that being bedridden for more than 3 days was associated with the development of DVT ($\chi^2=4.341$, $df=1$, $p=0.037$). There was significant association between patients who had completed TB treatment within the previous three months with development of DVT ($\chi^2=4.155$, $df=1$, $p=0.042$). There was no significant association between pregnancy and development of DVT ($p=0.157$) and patients on oral contraceptives with DVT diagnosis ($p=0.474$) (Table 1).

Past medical history

There was no statistically significant association between previous episodes of deep vein thrombosis and DVT ($\chi^2=1.595$, $p=0.207$). There was no association with history of CVP in affected limb and DVT ($\chi^2=3.457$, $p=0.63$).

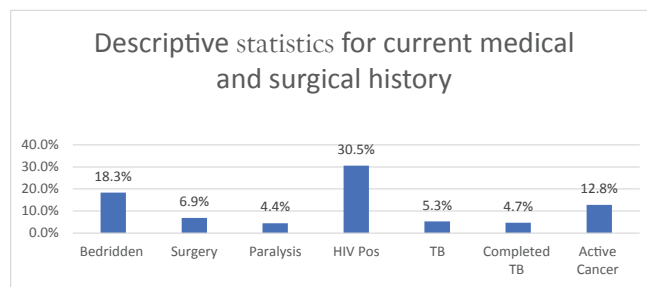


Figure 3: Descriptive statistics for current medical and surgical history.

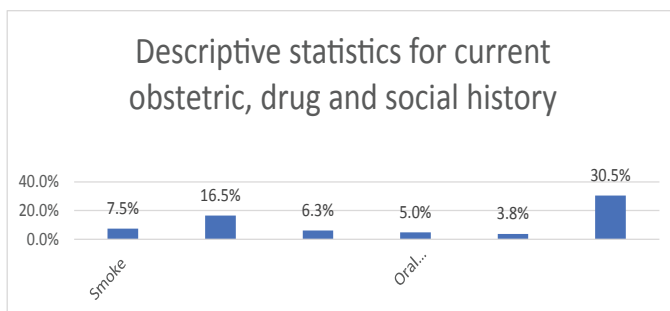


Figure 4: Descriptive statistics for current obstetric, drug and social history.

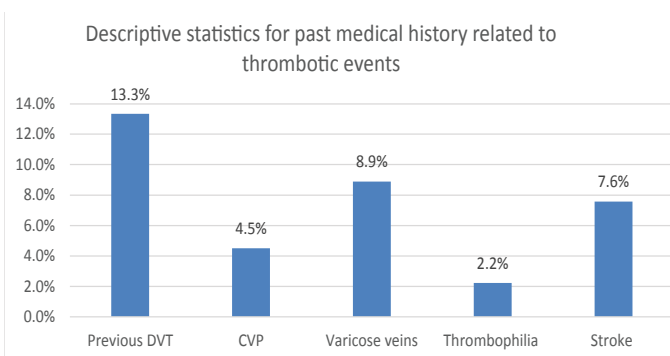


Figure 5: Descriptive statistics for past medical history related to thrombotic events.

Table 1: Association between current history and DVT diagnosis.

Factor	Developed DVT (n)%	No DVT (n)%	P-value
Bedridden more than 3 days	12(50%)	12(50%)	0.037
Recent surgery within 4 weeks	1(11%)	8(88%)	0.176
Paralysis/recent plaster of lower extremity)	2(33%)	4(66%)	0.925
HIV positive	17(43%)	23(57%)	0.053
Patients currently diagnosed with TB	4(57%)	3(43%)	0.12
Recently completed TB treatment within 3 months	4(67%)	2(33%)	0.042
Active cancer	5(29%)	12(71%)	0.857
Pregnancy	2(12.5%)	14(87.5%)	0.157
Postpartum	2(34%)	4(66%)	0.737
Oral contraceptives	2(40%)	3(60%)	0.474

Table 2 shows no statistical significant association between history of varicose veins and DVT ($\chi^2=1.358$, $p=0.244$). There was no significant association between history of clotting disorders (thrombophilia) and DVT ($\chi^2=1.417$, $p=0.234$). There was no significant statistical relationship between patients with history of heart disease and DVT ($\chi^2=0.26$, $p=0.871$).

Table 2: Association between past medical history and diagnosis.

Factor	Total number (n)	Current DVT in the study		P-value
		Diagnosed with DVT(n)%	Not diagnosed with DVT(n)%	
1.Previous episodes of DVT	18	8(44%)	10(56%)	1.595
2.History of CVP in affected limb	6	4(67%)	2(34%)	0.063
3.History of varicose veins	12	2(17%)	10(83%)	1.358
4.History of clotting disorders	3	0	3(100%)	0.234
5.History of heart disease/ heart attack/stroke	10	3(30%)	7(70%)	0.871

Eighteen (18) variables were evaluated and two showed a significant relationship with DVT. These were immobilisation for more than 3 days and recently completed TB treatment within 3 months. Their statistical power ranged from 0.0325 to 0.0414.

DISCUSSION

A total of 135 patients referred to radiology department for Doppler ultrasound imaging of the lower limbs between January and June 2019 participated in the study. Of these, 42 (31%) were diagnosed with DVT. The results showed that there was a significant association between: prolonged bedrest (patients bedridden for more than 3 days), recently completed TB treatment and development of DVT.

Immobility

This study demonstrated a strong association between patients bedridden for more than 3 days and development of DVT (p value=0.037). Similar results were observed in the study by Vululi et al. [14] at Mulago hospital in Uganda, which demonstrated that prolonged immobility was a risk factor for DVT among HIV positive patients attending out-patients department. Similar results were observed in a study at a teaching hospital in Zambia where DVT was associated with prolonged hospital stay of more than 7 days [7].

Tuberculosis (TB)

This study also demonstrated a statistically significant relationship between patients who had recently completed TB treatment with DVT (p value=0.042). Four of the six patients who completed TB treatment developed DVT within 3 months of completing their treatment. A study done at a teaching hospital in Lusaka, Zambia by Mwandama et al. [7] showed a similar association between TB and DVT among admitted medical patients. Similar results were also observed in a Johannesburg hospital where TB and HIV were associated with DVT [17].

According to Gupta et al. [18] the mechanism responsible for development of DVT in TB patients is unclear. However hypercoagulability, venous stasis, and endothelial dysfunction may play a role in pathogenesis of the disease. In patients with TB, hypercoagulability could be due to increased plasma fibrinogen and factor VIII, leading to reactive thrombocytosis [18].

HIV infection

In our study, 17 out of 40 (43%) HIV positive patients developed DVT compared to 23 out of 90 (25.6%) HIV negative patients who developed DVT. There was no statistical significance (p value of 0.053) between HIV and DVT in this study. This contrasts with other studies in South Africa, Zambia and Uganda which showed association between HIV and DVT [7,14,17]. The study by Goldstein and Wu [17] in South Africa represents a cohort of patients seen in 2013, while the one by Mwandama et al. [7] in Zambia was conducted in 2016. The current study at DGMMAH was conducted in 2019 at a time when South Africa had significantly improved roll out of anti-retroviral therapy (ART) programme among HIV positive patients.

South Africa had an estimated 7.7 million people living with HIV [19]. It had the largest ART programme in the world, with an estimated 4.8 million people accessing anti-retroviral therapy [19]. ART reduces opportunistic infections [20]. HIV patients with low CD4 cell count are at high risk of developing opportunistic infections and hospitalisation [14].

Although the proportion of HIV positive patients developing DVT was higher in the study compared to HIV negative patients, ART roll out could be contributing to the reduced risk of HIV positive patients developing DVT. A study by Arildsen et al. [21] demonstrated that anti-retroviral treatment (ART) improves markers of endothelial injury and coagulation.

Pregnancy

In our study, there was no statistical significance between pregnancy and DVT (p value of 0.157). This could be due to fewer pregnant patients diagnosed with DVT in our study. A meta-analysis done by Meng et al. [22] showed increased incidence of venous thromboembolism among pregnant patients and during puerperium.

Recent surgery

Patients undergoing surgical procedures are bedridden post-surgery, increasing the risk of DVT. A study by Zhang et al. [13] showed an increase in postoperative DVT in patients with bilateral hip fractures. Interestingly, only 1 of the 9 patients referred for ultrasound imaging in this study had developed DVT within 4 weeks of surgery. This could point towards improved management of patients post-surgery, with early ambulation, physiotherapy and prophylaxis to prevent DVT. A study by Wang and Ryan [2] demonstrated that the use of pharmacological and mechanical prophylaxis prevented venous thromboembolism in postoperative patients.

Oral contraceptives

In our study, there was no statistical significance between patients taking oral contraceptives and DVT (p=0.474). This could be due to few patients being on oral contraceptives in our study.

LIMITATION OF THE STUDY

In our study there were 135 participants. As a result of the small size of participants, our results could not be extrapolated to the

population of the hospital. This could have been an inaccurate reflection of thrombosis at a tertiary hospital.

This study focused on risk factors in patients with lower limb DVT and excluded patients with upper limb DVT. Patients in Intensive Care Unit (ICU), from whom consent could not be obtained were also excluded from the study.

Ultrasound imaging has its limitations as it is not the gold standard for diagnosis of DVT. In a few obese patients it was difficult to visualise veins, and in such patients contrast venography was used to diagnose DVT. These patients were also excluded from the study.

CONCLUSION

Prolonged immobility and recent completion of TB treatment were associated with increased risk of DVT. There is need to screen these patients for DVT early and actively institute DVT protocols in such patients to reduce their risk of developing DVT.

RECOMMENDATIONS

- a) ICU patients were excluded from the study due to difficulties in getting consent. We recommend empirical prophylaxis if there are no contraindications.
- b) In our study, few patients were referred for DVT post-surgery. A study to assess management practices to prevent DVT in post-surgical patients is recommended.
- c) TB patients should be monitored for DVT as they are at risk of developing it.

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