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INCIDENCE OF DEEP VEIN THROMBOSIS (DVT) IN PREGNANT AND POSTPARTUM PATIENTS WITH HIGH VENOUS THROMBOEMBOLISM (VTE) SCORES

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ABSTRACT

Background: About 1.2 pregnancies are affected by venous thromboembolism (VTE). In countries with high incomes, thrombosis and thromboembolism are major causes of mortality among mothers. In Ireland, venous thromboembolism (VTE), which includes both pulmonary embolism (PE) and deep vein thrombosis (DVT), is the main reason for sudden maternal mortality during the first six weeks following childbirth

Objectives: To find out the incidence of Incidence of Deep Vein Thrombosis (DVT) in Pregnant and Postpartum Patients with High Venous Thromboembolism (VTE) Scores.

Methodology: This cross-sectional study examined the incidence of Deep Vein Thrombosis (DVT) in pregnant and postpartum women at Letterkenny University Hospital from March 2021 to march 2023. Targeting females with high Venous Thromboembolism (VTE) risk scores, the study used probability sampling to select participants from medical records and antenatal clinics. Data was collected from medical record reviews, covering demographics, obstetric and medical history, VTE risk factors, and comorbidities. Diagnostic methods included Doppler ultrasound and CT Pulmonary Angiography (CTPA). Thromboprophylaxis use, adherence, and follow-up were also recorded. Data analysis with SPSS version 24 involved descriptive statistics and chi-square tests to assess DVT incidence and its associations with various factors. Ethical approval and informed consent were obtained, ensuring the study adhered to ethical standards**.**

Results: The study included 200 females aged 23-46 years (mean age 37±3.5 SD), with 77.5% over 35 years. Ethnically, 97.5% were Irish and 2.5% from other ethnicities. Most had high gravidity (95.5%) and parity (67%), with 95% having no prior VTE history. BMI ranged from 21 to 51.54 (mean 35.72±11 SD). Risk factors for VTE included smoking (7.5%), varicose veins (7.5%), and phlebitis (4%). Gestational diabetes mellitus was the most common comorbidity (22%), followed by essential hypertension (9.5%) and pregnancy-induced hypertension (7%). Only 1.5% of participants developed DVT, diagnosed via Doppler ultrasound or CT Pulmonary Angiography.

Thromboprophylaxis was administered to 91% (INNOHEP) and 7.5% (CLEXANE), with high adherence (93.5%). Follow-up varied, with most having stable conditions and no significant changes in VTE risk status.
Conclusion: The incidence of DVT among pregnant and postpartum patients with high VTE is low. Despite the presence of various risk factors and co morbidities, the overall incidence of DVT remains low, possibly due to effective thromboprophylaxis. The risk factors and comorbidities did not significantly elevate DVT incidence. Majority of the participants adhered to their prescribed thromboprophylaxis regimen. These findings highlight the effectiveness thromboprophylaxis strategies in reducing DVT incidence among high risk pregnant and post partum patients.

Keywords: Deep Venous Thrombosis, Venous Thromboembolism, Postpartum

INTRODUCTION

About 1.2 pregnancies are affected by venous thromboembolism (VTE).1 In countries with high incomes, thrombosis and thromboembolism are major causes of mortality among mothers.1,2 In Ireland, venous thromboembolism (VTE), which includes both pulmonary embolism (PE) and deep vein thrombosis (DVT), is the main reason for sudden maternal mortality during the first six weeks following childbirth.3 In addition, those who survived VTE may have long-term health problems such as chronic thromboembolic pulmonary hypertension (CTEPH) and post-thrombotic syndrome (PTS). When comparing to a non-pregnant state, the risk of pregnancy-associated venous thromboembolism (PA-VTE) is elevated in each of the 3 trimesters, peaking in the third trimester.2 At 0.6 per 1,000 pregnant women, the overall incidence of VTE is similar throughout the antepartum and postpartum periods, according to a thorough meta-analysis and review involving twenty research investigations.4 The period following childbirth has a greater daily risk of VTE, with its highest risk happening within the initial six weeks after the birth, although being shorter than the antepartum period.5 The development of post-thrombotic syndrome (PTS), a potentially crippling long-term consequence that can lower the standard of living, is significantly increased in women with PA-VTE.6

Despite a lack of other risk factors, pregnancy raises the risk of venous thromboembolism (VTE).7 When compared with non-pregnant individuals, the chance of VTE during the early stages of pregnancy is four to six times higher, and it can increase up to sixty times during after delivery.5,8 Pregnancy-induced hypercoagulable condition, thought to have developed as a defense against severe bleeding during delivery and pregnancy loss, is the main cause of this increased risk.8

The three factors that comprise "Virchow's triad"—endothelial injury, hypercoagulability, and venous stasis—help to understand the etiology of this prothrombotic condition. Changes in hormones that lower blood vessel tone and the enlarged uterus's blockage of venous flow led to venous stagnation. The syndrome is most noticeable between weeks 25 and 29 of pregnancy, when venous flow can be reduced by 50%. This decline can last up to six weeks after delivery.9 Endothelial injury can happen in the veins of the pelvis as a result of venous hypertension or during childbirth.10 The gas nitric oxide is normally released by endothelial cells in order to widen the placenta arteries and promote effective feto-maternal circulation. On the other hand, localized injury has the potential to interfere with the synthesis of angiogenic and anti-angiogenic factors, which might result in changed production of nitric oxide.11

Additionally, ‘a hypercoagulable state brought on by gestation is marked by lower levels of protein S, a resistance to activated protein C, higher levels of coagulation factors II, VII, VIII, and X, decreased fibrinolytic activity, and increased fibrin formation’.10 A ‘significant risk of developing pregnancy-associated VTE (PA-VTE), with an absolute risk exceeding 1%, is linked to specific single risk factors, such as acquired thrombophilia, strong hereditary thrombophilia’ “e.g., antithrombin deficiency with a robust family history”, or a prior VTE event’.12

Even while the rates of mortality among mothers in the United Kingdom and Ireland from venous thromboembolism (VTE) have significantly decreased, it is expected that more than two-thirds of these fatalities may be avoided with better treatment.3 The present study aims to find out the incidence of Incidence of Deep Vein Thrombosis (DVT) in Pregnant and Postpartum Patients with High Venous Thromboembolism (VTE) Scores.

MATERIALS AND METHODS

This cross-sectional study was conducted to investigate the incidence of Deep Vein Thrombosis (DVT) in pregnant and postpartum patients. The study took place at Letterkenny University Hospital, Letterkenny Co. Donegal F92 AE81, over a period from March 2021 to March 2023. The study targeted pregnant and postpartum females with high VTE scores, determined by recognized risk assessment models such as the Caprini Risk Assessment Model and Wells' Criteria for DVT. Inclusion criteria were being pregnant or postpartum women, while exclusion criteria included known contraindications to thromboprophylaxis or chronic anticoagulant use.

A probability sampling method was employed to select participants, who were identified through medical records and antenatal clinics. Data collection involved a structured questionnaire and a review of medical records, capturing demographic information (age, ethnicity), obstetric history (gravidity, parity), medical history (prior VTE events, family history of thrombophilias), clinical characteristics (Body Mass Index (BMI), gestational age for pregnant patients, postpartum status for postpartum patients), VTE risk factors (immobility, smoking, varicose veins, phlebitis), and comorbidities (gestational diabetes mellitus (GDM), pregnancy-induced hypertension (PIH), essential hypertension, and other relevant medical conditions).

Diagnostic methods for DVT included Doppler ultrasound and CT Pulmonary Angiography (CTPA). The study also recorded the types of thromboprophylaxis administered (e.g., INNOHEP, CLEXANE), duration and adherence to thromboprophylaxis, frequency and nature of follow-up visits, and changes in VTE risk status or clinical management. Data was entered and analyzed using SPSS version 24. Descriptive statistics such as frequencies, percentages, means, and standard deviations summarized the data. The chi-square test was used to analyze associations between categorical variables and the incidence of DVT.

The study was approved by the ethical committee of Letterkenny University, Hospital and informed consent was obtained from all participants. Confidentiality was maintained throughout the study, and participants were informed of their right to withdraw at any stage. Participants data was collected through medical records for collection demographic and clinical data and obstetric history, VTE risk factors, comorbidities, and previous VTE events.

VTE risk scores were calculated using established models, and the presence of DVT was confirmed using diagnostic imaging techniques. Participants received thromboprophylaxis based on clinical guidelines, with adherence monitored and recorded. Follow-up during pregnancy and the postpartum period aimed to monitor the development of DVT and adherence to thromboprophylaxis. Data analysis focused on determining the incidence of DVT and identifying associations between demographic/clinical factors and DVT occurrence. Descriptive statistics summarized the study population's characteristics, while inferential statistics, such as the chi-square test, assessed relationships between variables.

RESULTS

The total study's participants were 200 females. The age of the participants ranges from 23- 46 years old with the mean age of 37±3.5 SD. The majority of the participants are above 35 years of age 77.5%. Ethnically, the majority of the participants identify as Irish (97.5%) and two of them were from

another ethnicity (2.5%). In terms of obstetric history, the number of pregnancies (gravidity) above or equal to 3 were 95.5% while the number of births (parity) above or equal to 3 were 67%. Most participants (about 95%) have no prior history of venous thromboembolism (VTE) events or thrombophilias. Only 3% of the participants had VTE and 3.5% had family history of thrombophilia. (Table 1)

The BMI values of the participants ranged from 21 to 51.54, with a mean BMI of 35.72±11 SD indicating a wide range of body weights among the participants. Based on the provided data, the incidence of risk factors for venous thromboembolism (VTE) and associated comorbidities among the participants was assessed. Among the 200 participants, the presence of various risk factors for VTE included immobility, which was reported by 0.5% (1 participant). Smoking was a significant risk factor, present in 7.5% (15 participants) of the study population. Varicose veins were also identified in 7.5% (15 participants), while phlebitis was noted in 4% (8 participants). Additionally, a family history of VTE was reported by 3% (6 participants).
In terms of comorbidities, gestational diabetes mellitus (GDM) was the most prevalent, affecting 22% (44 participants). Pregnancy-induced hypertension (PIH) was present in 7% (14 participants), and essential hypertension was found in 9.5% (19 participants). Other less common comorbidities included Type 1 diabetes mellitus (0.5%, 1 participant), Type 2 diabetes mellitus (0.5%, 1 participant), transient ischemic attack (0.5%, 1 participant), antiphospholipid syndrome (0.5%, 1 participant), Hodgkin's lymphoma (0.5%, 1 participant), and cardiac problems (0.5%, 1 participant). Overall, 22.5% (45 participants) had at least one risk factor for VTE, and 41.5% (83 participants) had one or more comorbidities. This analysis highlights the significant presence of risk factors and comorbidities that may contribute to the incidence of deep vein thrombosis (DVT) in pregnant and postpartum patients with high VTE scores.

The incidence of Deep Vein Thrombosis (DVT), the use of thromboprophylaxis, and the associated follow-up data are shown in Table 2. Out of a total of 200 cases, only 3 cases (1.5%) of DVT were reported, diagnosed using Doppler ultrasound or CT Pulmonary Angiography (CTPA). This indicates a relatively low incidence of DVT among the sample population. Regarding thromboprophylaxis, the majority of patients received INNOHEP, which was administered to 182 individuals (91%). CLEXANE was used in 15 cases (7.5%), while 1 patient (0.5%) declined thromboprophylaxis and 2 patients (1%) did not receive any. Additionally, 2 cases (1%) had unspecified or incomplete data regarding their thromboprophylaxis regimen. (Table 2)
The adherence to thromboprophylaxis measures was generally high, with 187 cases (93.5%) following their prescribed regimen. However, 6 cases (3%) reported issues with adherence, predominantly among those receiving INNOHEP. There was 1 case (0.5%) where thromboprophylaxis was declined, and in 6 cases (3%), data on adherence was incomplete or unavailable. In terms of follow-up, the data varied significantly. Many patients, particularly those without DVT, had minimal or no additional admissions beyond routine checkups. For those with DVT or incomplete data, follow-up visits ranged from none to multiple admissions, with some cases having up to 5 admissions. There were no substantial changes in VTE risk status reported for the majority of cases, indicating stable conditions for most patients. (Table 2)

TABLE 1: PARTICIPANTS DEMOGRAPHICS

Characteristic	N (%)
Total Participants	200 (100%)
Age	
Range	24-46 years
< 35	45 (22.5%)
≥ 35	155 (77.5%)
Mean ±SD	37±3.5 SD

Ethnicity	
Irish	198 (97.5%)
Other	2 (2.5%)
Obstetric History	
Gravidity	
< 3	9 (4.5%)
≥ 3	191 (95.5%)
Parity	
<3	66 (33%)
≥ 3	134 (67%)
Pregnant	30 (15%)
Non-pregnant	170 (85%)
Medical History	
Prior VTE Events	6 (3%)
Family History of Thrombophilia	7(3.5%)

TABLE 2: DVT INCIDENCE, THROMBOPROPHYLAXIS MEASURES AND FOLLOW-UP DATA

Incidence of DVT	Thromboprophylaxis Measures	Mean Duration of Thromboprophylaxis	Mean Number of Follow-Ups	Percentages
DVT Incidence	**Medication**	**Adherence (Weeks)**	**Follow-Up (Number)**	**% of Cases**
No	CLEXANE	6.8 weeks	1.7	90.5%
No	INNOHEP	6.8 weeks	1.6	9.5%
Yes	INNOHEP	32 weeks	5.0	1.0%
Yes	INNOHEP	20 weeks	3.0	1.0%
Yes	INNOHEP	32 weeks	2.0	1.0%

DISCUSSION

The present study determined the incidence of DVT in pregnant and postpartum patients with high VTE scores and found a relatively low incidence of DVT i-e 1.5% despite the presence of risk factors and comorbidities. Our study is in accordance with a study conducted by Bates et al., which reported the incidence of 1.2 DVT cases per 1000 pregnancies.13 A study conducted by Knight et al in also found incidence rate of 1.3 per 1000 deliveries. These investigations suggested that with appropriate prophylaxis the incidence rate of DVR can be managed and reduced in high-risk population.14 In contrast a study conducted by Heit et al found a higher incidence of DVT in high risk pregnant and postpartum patients. This variation can be due to different study design, sample size and study population.15

Our study showed high adherence to thromboprophylaxis in our study participants (93.5%).this adherence is very important as showed by a study conducted by Jacobsen et al who suggested that using thromboprophylaxis consistently reduces the risk of DVT and pulmonary embolism significantly in patients with high risk pregnancy and postpartum women.16 The study findings conducted by Sultan et al., also coincides with our results showing that prophylaxis such as low molecular weight heparin (LMWH) can reduce the risk of VTE when adherence is high and consistent.17 Our results are also in accordance with Kahn SR et al., who showed that prophylaxis

can reduce the incidence of blood clots, risk of VTE and pulmonary embolism18. A study conducted by Helms J et al., also showed that thromboprophylaxis can reduce the risk of VTE and pulmonary embolism.19

The presence of comorbidities in our population such as gestational diabetes (22%) and essential hypertension (9.5%) also plays a critical role in highlighting the multifactorial nature of VTE. In accordance to our findings a study conducted by Sultan et al., found that gestational diabetes and hypertension as significant risk factors for VTE.20 A study conducted by Nan Li et al., also found that diabetes and hypertension are the risk factors for VTE.21 A study conducted by Lewandowska M et al., also found the similar results. 22

An important aspect of our study is the VTE risk in the postpartum period particularly within 6 weeks after the delivery. This finding is in accordance with a meta-analysis conducted by Kamel et al., who reported that highest risk of VTE in early postpartum period highlighting the need for careful monitoring, follow-up and prophylaxis during this critical time.23 Our study findings are also in consist with Elgendy IY et., who showed VTE as a risk factor in two months after delivery.24 A study conducted by Middleton P et al., also found VTE as a risk factor in early postpartum periods i-e 6 months after delivery.25

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