CEREBRAL VENOUS THROMBOSIS

Pregnant women's knowledge of venous thromboembolism in Malaysia

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Abstract

Background

Venous thromboembolism is an acute condition resulting in maternal morbidity and death.

Aims

This study aimed to assess venous thromboembolism knowledge among pregnant women in Malaysia.

Methods

A cross-sectional study was conducted among 143 pregnant women recruited via convenience sampling. Data gathered included demographic characteristics and knowledge of venous thromboembolism. The Fisher exact test examined the association between knowledge and outcome factors.

Results

Of the 143 pregnant women, 95.8% had low knowledge about venous thromboembolism. A significant association was found between level of knowledge and employment status (P=0.003) and monthly household income (P<0.001).

Conclusion

The study's participants demonstrated a deficit of knowledge of venous thromboembolism among pregnant women in Malaysia. Healthcare policymakers and maternal health services should put in place policies to improve pregnant women's knowledge of the danger of venous thromboembolism and its associated risk factors.

Venous thromboembolism refers to the formation of a thrombus within a vein, which can occur anywhere in the venous system and is a life-threatening illness (James, 2009; Wendelboe et al, 2015). The two types of venous thromboembolism are deep-vein thrombosis and pulmonary embolism (Krishna, 2020), and it is the third leading cause of vascular mortality globally (Nichols et al, 2020). Virchow's triad describes three broad categories of factors that may predispose a person to the development of venous thrombosis: hypercoagulability, venous stasis and endothelial injury (McLintock et al, 2012; Kushner et al, 2021). Deep vein thrombosis affects the left lower limbs most frequently because the right common iliac artery puts pressure on the left common iliac vein, preventing blood from returning to the heart and causing blood clots (Devis and Knuttinen, 2017; Khan et al, 2017).

The World Thrombosis Day Steering Committee recommends hospitals implement routine venous thromboembolism risk screening for all hospitalised patients (Forgo et al, 2022). Currently, the extent of global practices to assess the risk of hospital-associated venous thromboembolism is unknown. The global al incidence of venous thromboembolism is estimated to be 0.75–2.69 per 1000 people. Notably,

global awareness of venous thromboembolism is low (Wendelboe et al, 2022). In a population-based study in southeastern Nigeria, a country with a similarly low socioeconomic status as Malaysia, awareness of venous thromboembolism among the general population of adults was low (Okoye et al, 2021). A literature search reveals that few quantitative studies that focus on pregnant women's knowledge of venous thromboembolism have been conducted in developing countries.

The prevalence of venous thromboembolism increases approximately 4–5 times in pregnant women compared to the general population, and about 20 times in the postpartum period (Pomp et al, 2008; Maryam, 2013). Pregnancy is a well-known risk factor for venous thromboembolism because of the hypercoagulable state it induces and the uterus' blockage of the inferior vena cava (McLendon et al, 2022). Pregnancy causes a prothrombotic state in preparation for bleeding prevention at birth, to reduce the risk of postpartum haemorrhage. Production of factors I, II, VII, VIII, IX and X increase during pregnancy, and anti-thrombotic factors such as protein C and protein S become more resistant to activation of the body's natural anticoagulant system (Springel, 2018). Decreased venous flow velocity and venous distention, as well as obstruction of venous return by an enlarging uterus, lead to blood flow stasis. These factors account for 6–11% of pregnancy-associated deep vein thromboses (Kujovich, 2004; Di Prima et al, 2011).

In addition, pregnancy causes changes to hormones and blood flow, increasing the risk of developing a pulmonary embolism. Difficulty breathing, chest pain that intensifies with a deep breath or cough, coughing up blood and a faster than normal or irregular pulse are all signs and symptoms of a blood clot breaking off and travelling to the lungs (Orfanoudaki, 2019). Risk factors for venous thromboembolism include previous venous thromboembolism, thrombophilias, obesity (high body mass index, >25), immobility, superficial thrombophlebitis, stillbirth, assisted reproduction and postpartum infection. Family history, varicose veins, postpartum haemorrhage, emergency caesarean birth, hyperemesis, pre-eclampsia, smoking, being older than 35 years old, race and ethnicity are also factors associated with venous thromboembolism during pregnancy and birth (Khan et al, 2017).

Although most reports suggest that venous thromboembolism can occur at any trimester in pregnancy, studies suggest it is more common during the first half of pregnancy. Sequelae of deep vein thrombosis and pulmonary embolism include complications such as pulmonary hypertension, post-thrombotic syndrome and venous insufficiency (Springel, 2018). Vascular trauma during birth, especially births with assisted instrumental devices or caesarean section, further heightens the risk of postpartum thrombosis (Nichols et al, 2020).

In the UK, venous thromboembolism is the leading cause of direct maternal mortality (Mothers and Babies: Reducing Risk through Audits and Confidential Enquiries across the UK, 2019). Venous thromboembolism is the leading cause of maternal mortality in developing countries (James, 2009; Previtali et al, 2011), as well as in Malaysia (Department of Statistics Malaysia, 2021a). In the USA, venous thromboembolism has been found to affect between one in 500–2000 pregnancies within the first 6 weeks following birth (postpartum period) (Sultan et al, 2016). It can lead to post-thrombotic syndrome in pregnant and postpartum women, which is characterised by oedema, ulceration, skin abnormalities and death (Devis and

Knuttinen, 2017). In Denmark, venous thromboembolism has been identified in one in every 1000 pregnant women (Simcox et al, 2015).

In a cross-sectional study in Saudi Arabia, pregnant and postpartum women were found to lack understanding and awareness of venous thromboembolism (Ahmed et al, 2019). According to research conducted in Jeddah, women are unaware of the danger of venous thromboembolism and its repercussions (Alharbi et al, 2020). A study by Kim and Kim (2019) found that pregnant Korean women had a poor understanding of venous thromboembolism risk factors.

There is a lack of literature on topics related to pregnant women's knowledge of venous thromboembolism and associated risk factors. Thus, the present study aimed to assess venous thromboembolism knowledge among pregnant women in Malaysia, which might contribute to existing knowledge and fill the gap in the literature. The study's findings provide evidence-based information to hospital administrations, policymakers and government organisations so they can make the best possible effort to improve women's knowledge of venous thromboembolism.

Methods

Study design

A cross-sectional study was conducted to assess venous thromboembolism knowledge among pregnant women in Malaysia. A cross-sectional study means data from a single timepoint are collected once by surveys and questionnaires (Shanahan, 2010; Salkind, 2010). It allows researchers to compare different variables at the same time, for example, age, gender and education level, in relation to knowledge of venous thromboembolism.

Sample and setting

Pregnant women attending a weekly antenatal clinic at the Hospital Universiti Sains Malaysia, Kelantan, Malaysia, between January and February 2021 were invited to enrol by researchers in person. Women aged 18 years and above, regardless of gestational age were included. The exclusion criteria were having a personal or family history of venous thromboembolism.

To estimate sample size, two proportions were used with a margin of error of 5%, a confidence level of 95%, p1 of 57.1%, p2 of 42.9% and a power of study of 80% based on Jarab et al (2019). The calculated sample size was 130, and accounting for 10% dropout, the total sample size was 143.

The study setting was a teaching and referral hospital (Zaidun, 2009). Kelantan is a rural state with a population of more than 906 000 women and Malays make up approximately 95% of the population (Department of Statistics Malaysia, 2021b).

collection instrument

This study used a self-administered questionnaire with two parts. Part 1 asked for demographic data, such as age, ethnicity, educational level, employment status, monthly household income and parity. Part 2 had 32 items that determined participants' knowledge of venous thromboembolism, adopted from Jarab et al's (2019) study. Each correct answer was assigned one point, and an incorrect response was worth zero points. Therefore, the expected knowledge score was between 0 and 32 points. Knowledge scores were transformed into percentage scores using the formula: (raw mark x 100)/20 and categorised into low (<59%), moderate (60–79%), and high (>80%) to determine level of knowledge (Thandar et al, 2019).

Validity and reliability

Questions were formulated in English and then translated into Malay (the local language). Forward and backward translation was performed, and final versions were compared by three independent panel experts (an obstetrician, a midwifery lecturer and a medical statistician) to determine content validity and ethical soundness. A pilot test of the questionnaire with 10% of the sample size among pregnant women who did not participate in the main study was performed. The Cronbach's α was 0.927 for level of knowledge questions, indicating very good reliability (Taber, 2018).

Data collection

The researchers distributed a research information sheet to participants individually while they were waiting for antenatal care services at the clinic and then they completed the questionnaire either in English or the Bahasa Malaysia language. Informed consent and questionnaires were collected from participants by the study researchers. Women were given 10–15 minutes to complete the questionnaire.

Data analysis

Data were entered into the Statistical Package for Social Sciences. Descriptive statistics (means, standard deviations, frequencies and percentages) defined the study population. The Kolmogorov Smirnov test was used to see if data were suitable for normal distribution. Fisher's exact test was used to determine the association between demographic factors (age, ethnicity, educational level, job status, monthly family income and parity) and knowledge. $P \leq 0.05$ was considered significantly associated with the outcome variable.

Ethical approval

The study was authorised by the Universiti Sains Malaysia Human Research Ethics Committee (reference no: USM/JEPeM/20120650) and complied with the Declaration of Helsinki and institutional human research committees.

Following clearance from the institutional ethics review board and the hospital director, the Movement Control Order's current standard operating procedures were closely observed during recruiting and data collection, including physical distance measures and other constraints. In addition, all potential participants who expressed interest were invited for a briefing about the aim and study protocol. It was noted that

participation was entirely voluntary and participants could decline at any time without losing any benefit or care to which they were entitled.

Results

A total of 143 pregnant women completed the questionnaire. The findings of this study are presented under three headings: participants' demographic characteristics, participants' knowledge of venous thromboembolism and association between knowledge and demographic characteristics.

Participants' demographic characteristics

The demographic characteristics of the study participants are shown in Table 1. The mean age of participants was 31.56 years (standard deviation=5.37). The majority of participants (99.3%) were Malay. More than half had a degree (60.0%) and reported being unemployed (66.1%). The monthly household income was less than 4850 Malaysian Ringgit (MYR) (which is equivalent to 1167.69 USD based on the rate on 3 November 2021) for slightly more than half of the women (65.7%). In total, 75.5% of participants had previously given birth 1–3 times.

Table 1. Demographic characteristics of participants

Variable	Category	Frequency, n=143 (%) or mean (standard deviation)
Age (years)	Mean	31.56 (5.37)
Ethnicity	Malay	142 (99.3)
	Non-Malay	1 (0.7)
Education	Primary school	4 (3.0)
	Secondary school	53 (37.0)
	Degree	86 (60.0)
Employment	Employed	21 (33.9)

Variable	Category	Frequency, n=143 (%) or mean (standard deviation)
	Unemployed	41 (66.1)
Monthly household income (MYR)	Mean	4584.97 (3263.47)
	<4850	94 (65.7)
	4850–10959	35 (24.5)
	>10959	14 (9.8)
Parity	Mean	2.7 (1.78)
	1–3	108 (75.5)
	4–6	28 (19.6)
	>6	7 (4.9)

Participants' knowledge of venous thromboembolism

Table 2 outlines participants' knowledge of elements of venous thromboembolism. Overall, almost all women had low knowledge of venous thromboembolism (95.8%)

Table 2. Participants' knowledge of venous thromboembolism

Variable	Category	Frequency, n=143 (%)
Heard about blood clot in leg or deep venous thrombosis	Yes	25 (17.5)
	No	118 (82.5)
Cause of deep vein thrombosis (multiple responses possible)	Blood clot in vein*	18 (12.6)

Variable	Category	Frequency, n=143 (%)
	Lack of oxygen in the vein	6 (4.2)
	A tumour in the vein	1 (0.7)
	Lack of fluid in the vein	2 (1.4)
Signs and symptoms of deep vein thrombosis (multiple responses possible)	Swelling of leg*	17 (11.9)
	Itching of leg	1 (0.7)
	Pain in leg*	12 (8.4)
	Noticeable changes in the colour of the leg*	8 (5.6)
	Leg feels warm*	7 (4.9)
	Leg paralysis	1 (0.7)
	Leg jerking	3 (2.1)
Most common complication of deep vein thrombosis (multiple responses possible)	Pulmonary embolism*	13 (9.1)
	Recurrent deep vein thrombosis*	5 (3.5)
	Death*	4 (2.8)
	Post thrombotic syndrome*	4 (2.8)
	Diabetes	8 (5.6)

Variable	Category	Frequency, n=143 (%)
Heard about blood clot in lung or pulmonary embolism	Yes	18 (12.6)
	No	125 (87.4)
Signs and symptoms of pulmonary embolism (multiple responses possible)	Shortness of breath*	16 (11.2)
	Slow breathing	5 (3.5)
	Chest pain (may be worse with a deep breath)*	9 (6.3)
	Rapid heart rate*	10 (7.0)
	Lightheadedness*	4 (2.8)
	Pain radiating to the arm	1 (0.7)
	Coughing blood*	2 (1.4)
	Have frequent headaches	2 (1.4)
	Have frequent urination	1 (0.7)
Most common complication of pulmonary embolism (multiple responses possible)	Death*	10 (7.0)
	Pulmonary hypertension*	4 (2.8)
	Pleural effusion	2 (1.4)
	Asthma	5 (3.5)

Variable	Category	Frequency, n=143 (%)
Do you believe that comorbid diseases (like diabetes mellitus, hypertension, myocardial infarction, stroke, heart failure, and peripheral arterial disease) increase the risk of developing a venous thromboembolism?	Yes	106 (74.1)
	No	37 (25.9)
Conditions that might increase the risk of developing a blood clot (multiple responses possible)	A hospital stay*	11 (7.7)
	Surgery*	40 (28.0)
	Cancer*	12 (8.4)
	Not moving a long time*	54 (37.8)
	Pregnancy*	38 (26.6)
	Using estrogen-based meds*	4 (2.8)
	Family history of blood clots*	25 (17.5)
	Age older than 65*	11 (7.7)
	Too much exercise	1 (0.7)
	High blood cholesterol*	37 (25.9)
	Donating blood	0 (0.0)
	High blood pressure*	30 (21.0)
	Obesity*	50 (35.0)

Variable	Category	Frequency, n=143 (%)
	Varicose veins*	17 (11.9)
	Smoking*	13 (9.1)
	Eat less fibre	60 (42.0)
Activities that help prevent blood clots (multiple responses possible)	Walking*	84 (58.7)
	Stretching legs*	44 (30.8)
	Drinking plenty of fluids*	42 (29.4)
	Eating lots of fibre	31 (21.7)
	Bed rest	4 (2.8)
	Bathing regularly	2 (1.4)
	Massage	46 (32.2)
Overall knowledge	Low	137 (95.8)
	Moderate	5 (3.5)
	High	1 (0.7)

* Correct answer

Of the 143 pregnant women, only 17.5% had heard of venous thromboembolism and only 12.6% knew what causes deep vein thrombosis. Not many participants could correctly identify signs and symptoms of a deep vein thrombosis, which included swelling of the leg (11.9%), pain in the leg (8.4%), noticeable changes in colour of the leg (5.6%) and legs feeling warm (4.9%). Similarly, not many could correctly identify common complications of a deep vein thrombosis, which were pulmonary embolism (9.1%), death (2.8%) and post-thrombotic syndrome (2.8%).

Only 12.6% had heard of either a blood clot in the lung or pulmonary embolism and few participants could correctly identify signs and symptoms of a pulmonary embolism: shortness of breath (11.2%), rapid heart rate (7.0%), light-headedness (2.8%) and coughing blood (1.4%). Most (74.1%) pregnant women correctly reported that comorbid diseases increase the risk of developing venous thromboembolism.

A greater proportion of participants were able to name some of the conditions that increase risk of a blood clot, which included but were not limited to surgery (28.0%), not moving for a long time (37.8%), pregnancy (26.6%), family history of blood clots (17.5%), high blood cholesterol (25.9%), high blood pressure (21.0%) and obesity (28.0%). In terms of correctly identifying activities that prevent blood clots, 58.7% reported walking, 30.8% reported stretching their legs and 29.4% reported drinking plenty of fluids.

Factors associated with knowledge of venous thromboembolism

Table 3 shows demographic characteristics and their association with knowledge of venous thromboembolism. Employment status (P=0.003) and participants' monthly household income (P=0.000) were statistically significantly associated with knowledge. The subcategories of employed participants who had monthly household income of more than 4850 Malaysian Ringgit were more knowledgeable about venous thromboembolism.

Table 3. Association between demographic characteristics of participants and knowledge of venous thromboembolism

		Knowledge			
Variable	Category	Low, n=137 (%)	Moderate, n=5 (%)	High, n=1 (%)	P value
Age (years)	18–30	62 (98.4)	1 (1.6)	0 (0)	0.518
	31–40	69 (93.2)	4 (5.4)	1 (1.4)	
	>40	6 (100)	0 (0)	0 (0)	
Ethnicity	Malay	127 (96.5)	4 (2.8)	1 (0.7)	0.387

		Knowledge			
Variable	Category	Low, n=137 (%)	Moderate, n=5 (%)	High, n=1 (%)	P value
	Non-Malay	10 (0)	1 (100)	0 (0)	
Education	Primary school	4 (100)	0 (0)	0 (0)	0.291
	Secondary school	53 (100)	0 (0)	0 (0)	
	Degree	80 (93.0)	5 (5.8)	1 (1.2)	
Employment	Employed	16 (76.2)	4 (19.0)	1 (4.8)	0.003
	Unemployed	41 (100)	0 (0)	0 (0)	
Monthly household income (MYR)	<4850	94 (100)	0 (0)	0 (0)	0.000
	4850–10959	32 (91.4)	3 (8.6)	0 (0)	
	>10959	11 (78.6)	2 (14.3)	1 (7.1)	
Parity	1–3	102 (94.4)	5 (4.6)	1 (0.9)	0.756
	4–6	28 (100)	0 (0)	0 (0)	
	>6	7 (100)	0 (0)	0 (0)	

Discussion

The present study reports knowledge of venous thromboembolism in pregnant women in Malaysia. More than three-quarters of participants had low knowledge and only one had a high level of knowledge. Although some were aware of deep vein thrombosis and pulmonary embolism, most could not correctly identify signs, symptoms and consequences of either issue. These findings are in line with previous research that revealed a lack of understanding of the signs and symptoms of venous thromboembolism among pregnant women in Saudi Arabia (**Ahmed et al, 2019**).

There is a paucity of information regarding the indications, symptoms, risk factors, consequences and prevention of venous thromboembolism in the global population (**Wendelboe et al, 2015**). A street study conducted in Birmingham found that the general public's knowledge of deep vein thrombosis was minimal (**Boulton et al, 2015**). Similarly, women who have had a caesarean section have been shown to lack understanding of venous thromboembolism clinical manifestations, risk factors and symptoms (**Alzoubi et al, 2013**). The present study found that although participants were more knowledgeable about deep vein thrombosis than pulmonary embolism, they were unaware that a deep vein thrombosis might progress to a pulmonary embolism.

Additionally, the participants had low knowledge of risk factors and prevention strategies for both deep vein thrombosis and pulmonary embolism. However, they could correctly identify that not moving for a long time was a common risk factor of venous thromboembolism, which corresponds with other studies from Saudi Arabia (**Almodaimegh et al, 2017**). Other risk factors include smoking, cancer, a hospital stay, being older than 65 years and using oestrogen-based medications, all of which were not identified by most participants. Most participants selected walking as a way to prevent deep vein thrombosis or pulmonary embolism, which is consistent with findings from Jordan (**Jarab et al, 2019**).

Healthcare providers should educate pregnant women on venous thromboembolism and risks. Many participants mistakenly reported that eating a high-fibre diet can prevent blood clots. A plausible explanation for this might be that pregnant women associate comorbid illnesses, including diabetes, hypertension, myocardial infarction, stroke, heart failure and peripheral artery disease with the risk of venous thromboembolism and these comorbidities can be avoided by eating a healthy, high-fibre diet (**Threapleton et al, 2013**). Pregnant women's knowledge of venous thromboembolism should be increased through health education, as knowledge level of deep vein thrombosis among hospitalised patients has been shown to improve after educational training (**Serpici and Gürsoy, 2018**).

Factors associated with knowledge of venous thromboembolism

Education has been shown to be a key determinant of knowledge of venous thromboembolism (**Diaz-Quijano et al, 2018**). Pregnant women with a higher level of education may be better able to identify venous thromboembolism and, therefore, be more likely to seek medical help in time. Low knowledge may indicate insufficient health education, which is a concern and a lack of knowledge of venous thromboembolism

could negatively impact prevention. Pregnant women with insufficient knowledge of venous thromboembolism may therefore need more attention and consideration from healthcare professionals, particularly nurses or midwives, during antenatal health education sessions to enhance their knowledge and understanding.

However, the present study's result showed no association between education and knowledge of venous thromboembolism, despite most participants showing low knowledge of the condition. This low level of knowledge may be the result of a lack of health education programmes on venous thromboembolism in Malaysia. Other studies have demonstrated an association between education and receiving information about a disease and its manifestation, as well as increased awareness of the disease. For example, awareness of stroke and its signs and symptoms has been found to be higher in those with higher education and those who received health education about the disease through campaigns, websites and public education (**Oh et al, 2016**). Similarly, a randomised controlled study demonstrated that postpartum women's awareness and knowledge of venous thromboembolism were significantly higher after an intervention using a health educational programme (**Youness et al, 2016**).

The present study found that employment status was significantly associated with pregnant women's knowledge of venous thromboembolism. **Alharbi et al's (2020)** cross-sectional study using a self-administered web-based survey of Saudi women from Jeddah reported a similar result. A plausible explanation could be that employed women may have a higher exposure to knowledge from the working environment, which can serve as an important source of information. Information and experiences can be shared between women in the workplace, improving knowledge. Thus, working status appears to impact women's knowledge. Investigations in Egypt (**Rashad and Essa, 2010**) and Jordan (**Okour et al, 2012**) found similar results, although no association was found in Ethiopia (**Hailu and Berhe, 2014**).

Monthly household income was also a factor that impacted pregnant mothers' knowledge. **Alharbi et al (2020)** found similar results that indicated that women with a higher socioeconomic class had a higher level of knowledge of venous thromboembolism. Women with a higher socioeconomic status may be less deterred by cost barriers when seeking obstetric and antenatal care. This allows women a greater chance to gain information and learn about venous thromboembolism in pregnancy (**Doctor et al, 2013**).

Age, ethnicity, education and parity had no association with knowledge of venous thromboembolism, consistent with a study in Saudi Arabia (**Almodaimegh et al, 2017**). However, a study conducted with Saudi women in Jeddah reported that high knowledge of venous thromboembolism during pregnancy was associated with younger age, higher education and a lower number of births (**Alharbi et al, 2020**). The present study's findings regarding age may be because most of the participants were aged 31–40 years, suggesting an insufficient number of young participants to establish a causal link.

The present study found no association between knowledge of venous thromboembolism and ethnicity. The population of Malaysia is 32.6 million, with Malays forming the largest ethnic group (69.6%) (**rtment of Statistics Malaysia, 2021c**). In the present study, only one participant was of non-Malay

ethnicity, which likely means there were insufficient representatives from other ethnicities for an association to be established. Future research should ensure non-Malay pregnant women in Malaysia are included, to better represent the population of Malaysia.

Limitations

There were some limitations to this study. First, the target population was pregnant women who were chosen from a convenience sample of those who visited an antenatal clinic at a tertiary teaching hospital in Malaysia. Consequently, the findings cannot be extrapolated to all pregnant women in Malaysia or to those in other nations. Second, data collection was done during the COVID-19 pandemic, and researchers followed the standard operation procedures in place at the time, which included physical distancing measures. The pandemic may have influenced participants' replies, although the study's recommended sample size was met.

Conclusions

This study found that knowledge of venous thromboembolism among pregnant women in Malaysia is generally poor. Recognising the signs and symptoms of venous thromboembolism, its risk factors and what to do if it occurs can empower pregnant women to take essential steps to ensure a safe birth and seek medical attention when necessary. Policymakers and maternal health providers in Malaysia should ensure greater efforts are made to educate pregnant women on the dangers of venous thromboembolism.

Key points

- Venous thromboemobolism is the second-highest leading cause of maternal death in Malaysia
- Pregnant women are at increased risk of developing venous thromboembolism
- Failure to recognise venous thromboembolism-related signs and symptoms during pregnancy are a major factor in delaying treatment, resulting in maternal morbidity and mortality
- This study found that pregnant women had low knowledge of venous thromboembolism
- Employment and monthly household income impact women's knowledge of venous thromboembolism

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