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Venous thromboembolism in pregnancy among Chinese women in a regional hospital in Hong Kong: a 20-year cross-sectional case-control study

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Objective: To determine the prevalence and risk factors of venous thromboembolism (VTE) in pregnancy among Chinese women in a regional hospital.
Methods: Medical records of ethnic Chinese residents who delivered at ≥24 weeks of gestation or earlier with active resuscitation between January 2004 and December 2023 at Pamela Youde Nethersole Eastern Hospital were retrospectively reviewed. To determine VTE prevalence, cases occurring during pregnancy and the postpartum period (up to 6 weeks after delivery) were identified. To determine risk factors for VTE, cases were compared with matched controls (within 3 days of the delivery date) at a 1:5 ratio.
Results: In total, 22 cases of VTE occurring in the antepartum (n=15) or postpartum (n=7) period were identified. The prevalence was 0.5 per 1000 deliveries. Of the 22 cases, 16 were deep vein thrombosis, three were pulmonary embolism, and three involved both conditions. The most common symptom was limb swelling or pain (n=17). Two patients experienced cardiac arrest and underwent perimortem Caesarean section and subsequent mechanical thrombectomy by interventional radiologists. The remaining 20 patients with VTE received low-molecular-weight heparin treatment. The case and control groups were comparable, except that the case group had higher rates of substance use (13.6% vs 0.9%, p=0.001), varicose veins (4.5% vs 0%, p=0.025), preterm delivery (27.3% vs 7.3%, p=0.005), Caesarean section (63.6% vs 36.4%, p=0.018), blood transfusion (22.7% vs 2.7%, p<0.001), and stillbirth or neonatal death (4.5% vs 0%, p=0.025).
Conclusion: The prevalence of VTE in pregnancy among Chinese women in Hong Kong was 0.5 per 1000 deliveries, lower than that reported internationally. The risks and benefits of pharmaco-prophylaxis should be weighed on an individual basis.

Keywords: East Asian people; Pregnancy complications, cardiovascular; Venous thromboembolism

Introduction

Pregnancy is a hypercoagulable state that develops as a protective mechanism to reduce haemorrhage at childbirth. It increases the risk of venous thromboembolism (VTE), which is a leading cause of maternal death[1]. Prophylactic measures include compression stockings, early mobilisation, and pharmaco-prophylaxis; however, the latter is associated with bleeding risks. Risk-benefit analysis depends on the presumed prevalence of bleeding risks in different populations. The prevalences of VTE in pregnancy have been reported to be 1.4 per 1000 worldwide and 1.3 per 1000 in the Chinese population[2,3]. In Hong Kong, the reported prevalence ranges from 0.4 to 1.88 per 1000 in tertiary units[4,5]. We aimed to determine the prevalence and risk factors of VTE in pregnancy among Chinese women in a regional hospital across 20 years.

Methods

Medical records of ethnic Chinese residents who delivered at ≥24 weeks of gestation or earlier with active resuscitation between January 2004 and December 2023 at Pamela Youde Nethersole Eastern Hospital were retrospectively reviewed. Non-local residents were excluded, as were women with ectopic pregnancies, miscarriages, or abortions before fetal viability. During the study period, no standardised protocols or routine pharmaco-prophylaxis for VTE prevention in pregnancy were implemented. Clinicians provided prophylactic measures on an individual basis; non-pharmacological measures, such as compression stockings, were commonly prescribed for prolonged hospitalisation.

Data retrieved included anticoagulant use, limb ultrasound scans, computed tomography thoracic scans, ventilation-perfusion scans, and diagnoses of VTE and related conditions between 280 days (40 weeks) before

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delivery and 100 days (~14 weeks) after delivery. There were no missing data.

To determine VTE prevalence, cases occurring during pregnancy and the postpartum period (up to 6 weeks after delivery[6]) were identified. Cases were excluded if associated with prophylactic anticoagulant use, negative imaging findings, or a history of VTE without active disease during pregnancy.

To determine risk factors for VTE, cases were compared with matched controls (within 3 days of the delivery date) at a 1:5 ratio to maximise statistical power[7]. The two groups were compared using the Chi-squared test for categorical variables and the *t* test for continuous variables. Statistical analysis was performed using SPSS (Windows version 29.0; IBM Corp, Armonk [NY], US).

Results

Among 43 626 deliveries by Chinese residents, 22 cases of VTE occurring in the antepartum (n=15) or postpartum (n=7) period were identified. The prevalence was 0.5 per 1000 deliveries. Of the 22 cases, 16 were deep vein thrombosis, three were pulmonary embolism, and three involved both conditions (Table 1). The most common symptom was limb swelling or pain (n=17). Two patients experienced cardiac arrest and underwent perimortem Caesarean section and subsequent mechanical thrombectomy by interventional radiologists. The remaining 20 patients with VTE received low-molecular-weight heparin treatment. Only 11 of the 22 patients underwent thrombophilia screening after the VTE event.

The case and control groups were comparable, except that the case group had higher rates of substance use (13.6% vs 0.9%, p=0.001), varicose veins (4.5% vs 0%, p=0.025), preterm delivery (27.3% vs 7.3%, p=0.005), Caesarean section (63.6% vs 36.4%, p=0.018), blood transfusion (22.7% vs 2.7%, p<0.001), and stillbirth or neonatal death (4.5% vs 0%, p=0.025) [Table 2]. Indications for Caesarean section included placenta previa, maternal disease, twin pregnancy, failed induction after preterm prelabour rupture of membranes, and cardiac arrest.

Table 1. Characteristics of the 22 cases of venous thromboembolism (VTE).

Characteristic	Value*
Occurrence	
Antepartum	15 (68.2)
>1st trimester	5 (33.3)
>2nd trimester	2 (13.3)
>3rd trimester	8 (53.3)
Postpartum	7 (31.8)
Presentation	
Limb swelling or pain	17 (77.3)
Cardiac arrest	2 (9.1)
Others (shortness of breath, stroke, tachycardia)	3 (13.6)
VTE type	
Deep vein thrombosis	16 (72.7)
Pulmonary embolism	3 (13.6)
Both	3 (13.6)
Site of deep vein thrombosis	n=19
Left lower limb	12 (63.2)
Right lower limb	5 (26.3)
Bilateral lower limbs	1 (5.3)
Left upper limb	1 (5.3)
Site of pulmonary embolism	n=6
Right main artery	1 (16.7)
Right lobar artery	2 (33.3)
Right segmental artery	1 (16.7)
Bilateral main arteries	1 (16.7)
Bilateral lobar arteries	1 (16.7)
Treatment	
Low-molecular-weight heparin	20 (90.9)
Thrombectomy	2 (9.1)
Thrombophilia screening	11 (50)

* Data are presented as No. (%) of cases

Discussion

The incidence of VTE is lower among Asians, including ethnic Chinese[8-10]. The prevalence of VTE in pregnancy in our hospital between 2004 and 2023 was 0.50 per 1000 deliveries (31.8% occurred postpartum), which was lower than the 1.3 per 1000 deliveries reported in the Chinese population[3] and the 1.88 per 1000 deliveries (75% occurred postpartum) reported between 1998 and 2000 at Prince of Wales Hospital, Hong Kong[4]. It was similar to the 0.4 per 1000 deliveries (one case occurred postpartum) reported between 2004 and 2016 at Queen Mary Hospital, Hong Kong[5]. Regional differences within Hong Kong may reflect variations in socioeconomic status; higher socioeconomic status is associated with a decreased risk of VTE[3,11].

In the present study, inclusion of only local residents may have minimised cases with incomplete information or

Table 2. Risk factors for venous thromboembolism (VTE).

Variable	VTE*		p Value
	Yes (n=22)	No (n=110)	
Age, y	33.5±4.3	33.2±4.4	-
Nulliparous	12 (54.5)	50 (45.5)	0.435
Parity			0.183
0	12 (54.5)	50 (45.5)	
1	7 (31.8)	49 (44.5)	
2	2 (9.1)	10 (9.1)	
3	0	0	
4	0	1 (0.9)	
≥5	1 (4.5)	0	-
Body mass index, kg/m^2	22.87±3.38	22.57±3.49	0.711
Smoker	4 (18.2)	8 (7.3)	0.104
Substance use	3 (13.6)	1 (0.9)	0.001
Comorbidities	1 (4.5)	0	0.025
Cardiac	0	1 (0.9)	0.653
Antiphospholipid syndrome	0	0	-
Systemic lupus erythematosus	0	1 (0.9)	0.653
History of VTE	0	0	-
Varicose veins	1 (4.5)	0	0.025
Others (sickle cell disease, urinary tract infection, irritable bowel disease)	0	0	-
Gestational diabetes	3 (13.6)	25 (22.7)	0.341
Pre-existing diabetes	1 (4.5)	1 (0.9)	0.202
Chronic hypertension	0	0	-
Pregnancy-induced hypertension	0	1 (0.9)	0.653
Pre-eclampsia	1 (4.5)	3 (2.7)	0.650
Intrauterine growth restriction	0	1 (0.9)	0.653
Artificial reproductive technology	2 (9.1)	5 (4.5)	0.385
Gestation at delivery, wk	38.1±2.1	38.9±1.5	0.056
Preterm delivery	6 (27.3)	8 (7.3)	0.005
Multiple pregnancies	2 (9.1)	3 (2.7)	0.153
Mode of delivery			0.048
Vaginal	6 (27.3)	60 (54.5)	
Instrumental	2 (9.1)	10 (9.1)	
Caesarean	14 (63.6)	40 (36.4)	0.018
Blood loss, mL	995±1974	311±210	0.119
Blood transfusion	5 (22.7)	3 (2.7)	<0.001
Manual removal of placenta	0	2 (1.8)	0.524
Stillbirth/neonatal death	1 (4.5)	0	0.025

* Data are presented as mean±standard deviation or No. (%) of cases

loss to follow-up. Most women remain in hospital for 3 to 5 days postpartum; most postpartum VTE occurs within the first week[12] and should therefore have been captured, particularly 90% of admissions are under Hospital Authority[13]. Although routine pharmaco-prophylaxis was not provided, mechanical measures (eg, compression stockings) for prolonged hospitalisations were offered on an individual basis. Routine pharmaco-prophylaxis during antepartum and postpartum periods has become more common in recent years[14]. Additionally, increased awareness of VTE, along with early mobilisation and adequate hydration postpartum, may reduce the incidence of postpartum VTE[15]. This trend of improved obstetric practice has also been observed internationally[1].

Although the bleeding risks associated with pharmaco-prophylaxis are not negligible[14,16], VTE in pregnancy remains uncommon in Hong Kong; thus, the risks and benefits of pharmaco-prophylaxis should be carefully weighed on an individual basis[8].

Most VTEs were of deep vein thrombosis; symptoms predominantly affected the left lower limb, consistent with venous stasis in pregnancy[17]. Most cases occurred in the third trimester and postpartum periods. Maternal cardiac arrest is an uncommon presentation of pulmonary embolism in pregnancy[18]. Thrombectomy is preferred over thrombolysis, which may cause life-threatening haemorrhage[19], highlighting the importance of interventional radiologist availability in obstetric units[20]. Among patients with VTE, the prevalence of thrombophilia is high[21]. However, thrombophilia screening does not alter management and is therefore no longer advocated[22].

Most patients with VTE had no known risk factors or comorbidities; only one had varicose veins. Risk factors for VTE include maternal age >35 years and obesity; lower prevalences of these risk factors may contribute to a reduced risk of VTE[23]. Clinicians should maintain a high index of suspicion in pregnant women with symptoms suggestive of VTE, given that pregnancy itself is a risk factor[22,24]. Substance abuse is associated with VTE in pregnancy, underscoring the importance of prevention and intervention efforts[25]. Most postpartum VTEs are preceded by Caesarean section[23]. Anticoagulation increases the risk of bleeding at delivery and postpartum, as well as the likelihood of blood transfusion, which itself is a risk factor for VTE[23].

The present study had several limitations. Considering the retrospective study design, patients' medical histories may not have been comprehensively recorded, and risk factors may have been underreported, potentially limiting the reliability of the results.

Conclusion

The prevalence of VTE in pregnancy among Chinese women in Hong Kong was 0.5 per 1000 deliveries, lower than that reported internationally. The risks and benefits of pharmaco-prophylaxis should be weighed on an individual basis.

Contributors

All authors designed the study, acquired the data, analysed the data, drafted the manuscript, and critically revised the manuscript for important intellectual content. All authors had full access to the data, contributed to the study, approved the final version for publication, and take responsibility for its accuracy and integrity.

Conflicts of interest

All authors have disclosed no conflicts of interest.

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Data availability

All data generated or analysed during the present study are available from the corresponding author on reasonable request.

Ethics approval

This study was approved by the Hospital Authority Central Institutional Review Board (reference: CIRB-2024-601-5). The patients were treated in accordance with the tenets of the Declaration of Helsinki. The requirement for patient consent was waived by the Committee due to the retrospective nature of the research.

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