

Advances in Applied Biological Research

Year 2025, Volume-2, Issue-1 (January - June)



Deep Vein Thrombosis associated with Cesarean Delivery: An Overview Illustrative Study

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ARTICLE INFO

Keywords: Deep vein, Thrombosis, Cesarean Delivery, illustrative study

DOI: 10.48165/aabr.2025.2.1.03

ABSTRACT

The risk of deep vein thrombosis (DVT) in women is strongly associated with pregnancy, the risk increasing by 5 to 10 times. This risk then gradually increases until it peaks during and after delivery. Blood clots are one of the most feared complications after childbirth. They usually occur in the legs or pelvis and can dislodge and travel to the lungs, causing pulmonary embolism. It can be controlled on this state by using blood-thinning medications to avoid death. This problem occurs as one complication of a cesarean section, which involves a surgical technique for delivering a baby through an incision in the abdomen and uterus. It is performed as an alternative to vaginal delivery. Although the risk of venous thromboembolism increases with surgical delivery, there is no consensus on the prevention of clots after cesarean section.

Introduction

Deep vein thrombosis (DVT) is a term that refers to an abnormal blockage within the body's veins. This blockage results from a blood clot passing through these blood vessels, leading to poor or insufficient blood flow back to the heart, also known as venous return (Pomp et al., 2008). VTE may possibly occur in several veins in the human venous system throughout the whole body, with either pulmonary thromboembolism (PE) or deep venous thrombosis (Essien, Rali, & Mathai, 2019). Venous thromboembolism is a condition that occurs as a result of various causes and multiple factors. It is characterized by its rapid impact on

the human body, so it is one of the conditions that do not produce early symptoms. Thus, deep vein thrombosis (DVT) and pulmonary embolism (PE) are unexpected (Alzoubi et al., 2013). In pregnancy, thrombophilia is one of the most significant risk factors for deep vein thrombosis. Other factors related to pregnant women that may increase the risk of venous thrombosis include obesity, a history of DVT, obstetric hemorrhage, maternal age over 35 years, varicose veins, preeclampsia, cardiovascular disease, anemia, smoking and alcohol abuse, and multiple pregnancies (Tepper et al., 2014). Many studies have confirmed that cesarean delivery is considered one of the risk factors for women developing venous thrombosis (Abd Al Karim et al., 2014), especially

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when it is performed urgently without any preparatory and preventive measures in advance.

There is also a close link between cesarean section and the advanced age of the pregnant woman, as this facilitates and contributes to the occurrence of venous thrombosis, as the mother often rests and lies down for long periods after the operation. This leads to blood stagnation and impaired blood circulation, which in turn leads to venous thrombosis (Salveti et al., 2021). Sometimes, venous thrombosis can cause a chronic condition in women called post-thrombotic syndrome (PTS). This long-term condition results in a number of physical problems, such as edema of varying degrees, eczema, anxiety, discomfort, and a reduced quality of life, in addition to increased medical costs (Wik et al., 2012). Furthermore, intrauterine growth retardation, preeclampsia, recurrent miscarriages, fetal death, and other pregnancy-related complications are associated with risk factors that lead to deep vein thrombosis, which can have negative effects on women's overall health. Some studies indicate that the increase in pregnancies associated with certain life-threatening risk factors, including obesity and advanced maternal age, may lead to an increase in pregnancy-related thromboembolism and, consequently, increased rates of morbidity and mortality (Ali et al., 2025).

Incidence of DVT among Pregnant and Postpartum Women Underwent CS

Globally, the incidence of venous thromboembolism (VTE) in pregnant women is approximately 0.1% to 0.2%, a rate five times higher than that of non-pregnant women of the same age. The incidence rate then increases to approximately 60 times that of women in the postpartum period (Jackson, Curtis, Gaffield., 2011). Venous embolism states, which involve pulmonary thromboembolism (PTE) and deep venous thrombosis (DVT), in the Western world, where it occurs in 3 out of every 1,000 pregnancies, post-cesarean pulmonary embolism is a leading cause of maternal morbidity and mortality (Pandey et al., 2015). In China/Hong Kong, according to the hospital of the Queen Mary, the incidence of venous thromboembolism among women as a problem and complication during pregnancy has reached approximately 0.4 per 1,000 pregnancies (Huang et al., 2019). In the Middle East, the incidence of deep vein thrombosis (DVT) among women during pregnancy or postpartum is 21.0%. This rate is considered acceptable and low risk when compared to the global incidence of DVT, which is 51.4%. In the same context, a study conducted among several nationalities found that the incidence of DVT among women in the Arab Gulf countries is 32% during pregnancy or the period following it (Hosny et al., 2020). In Iraq, according to the Ministry of Health's mortality report for the years 2013, 2014, and 2015, pulmonary embolism, which results from deep vein thrombosis, was the second most common cause

of maternal death, accounting for 19%, 17%, and 14% of all maternal deaths in the years mentioned above, respectively. Thromboembolism is a serious problem affecting the human circulatory system, resulting in a disruption of blood flow in the blood vessels. It was also the second most common cause of death among women in 2010, 2011, and 2012, while the most common cause of death among women was postpartum hemorrhage in Iraq (Hassan, and Mohammed SJ. 2022).

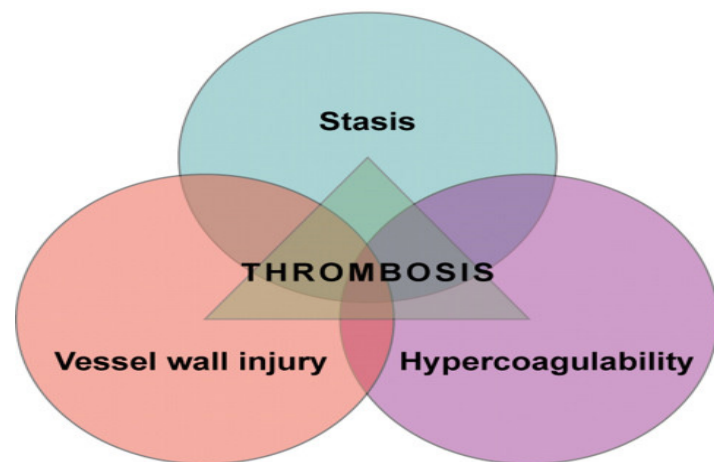
On the other hand, racial factors play a role in women's exposure to deep vein thrombosis after a cesarean section. This is evident when comparing black and white women. The risk is 50% higher among black women, while it decreases by 30% among Asian women and is even lower among Hispanic women. It has been observed that the increased risk of postpartum venous thromboembolism in African women is associated with cesarean delivery (Blondon et al., 2014). Race also plays a role in this regard, as it has been shown that the mortality rate for African-American women in the United States due to venous thromboembolism is 4.5 times higher than that of Caucasian women, at 4.1 per 100,000 live births and 0.9 per 100,000 live births, respectively (Heyl PSet al., 2013).

Pathophysiology of the Thrombus

Pregnancy is a major risk factor for women developing deep vein thrombosis (DVT), both during and after pregnancy, including childbirth. Factors that contribute to the formation of DVT are known as Virchow's triad, which centers around venous stasis, hypercoagulability, and endothelial damage. Women are five times more likely to develop DVT during pregnancy and childbirth than women of the same age (Kilkenny K, and Frishman. 2024). Due to an increase in clotting factors, including factors VII and X, as well as an increase in fibrinogen, and a corresponding decrease in the coagulation inhibition process in the woman's body, this leads to hypercoagulation. Due to the increase in the size of the uterus during pregnancy, it leads to pressure on the inferior vena cava and iliac veins, thus reducing the rate of venous return from the lower extremities, causing blood stagnation in the veins. After childbirth, some complications may occur that accompany the birth of the fetus, including damage to the lining of the blood vessels, and the situation may worsen in cases of cesarean section. These factors can cause the formation of venous thrombi (Obeagu, Obeagu, and Ogunnaya, 2023). The period following childbirth, accompanied by a woman's inactivity and reduced mobility after a cesarean section, is a predisposing factor for increased risk of thromboembolism as part of the pathophysiology of this condition. For a numerical comparison, women's exposure to deep vein thrombosis (DVT) during different births is approximately one case per 1,000 in vaginal births, while this figure increases to 3 cases per 1,000 in cesarean births. Similarly, the mortality rate due to DVT for women

who undergo cesarean delivery is ten times higher than for those who undergo vaginal birth (Sénat et al., 2016).

After childbirth, hypercoagulability typically persists for at least fourteen to twenty-one days, which explains the variability in the time it takes for bleeding to stop during the postpartum period. Regardless of careful consideration of the method of delivery, whether cesarean or vaginal, reactive thrombocytosis, which is strongly associated with increased risk of thrombosis, is a common condition that typically occurs in the postpartum period (García et al., 2022). The postpartum period is also characterized by elevated levels of tissue factor, a closely related factor that plays a role in increasing levels of factor VII (FVIIa), which activates coagulation and thrombin formation. However, some scientific studies have shown that there are no significant differences between birth types in stimulating coagulation levels based on tissue factor. The presence of this factor in the bloodstream accelerates the formation of tissue factor VII, which is the main axis for generating the hemostasis system. After this process, with the presence of factor X, the chance of forming limited amounts of thrombin increases, which in turn contributes to the activation of platelets, as well as the tools that assist in activating factors V and VIII, thus gradually increasing the circulatory response to coagulation during the postpartum period (de Moreuil et al., 2023). In addition, it has been observed that high plasma homocysteine levels play a major role in inhibiting the formation of endothelial nitric oxide (NO), which results in endothelial problems in women who underwent cesarean section compared to those who delivered vaginally (Kobayashi, Reid, Hadfield, 2014).



Virchow's triad diagram [Kushner et al., 2024]

Prophylactic and Therapeutic Measures

Preventing thromboembolism is crucial for women who deliver by cesarean section. The prophylaxis involves medical guidelines and therapeutic measures to reduce these potentially life-threatening complications, as high rates of postpartum mortality have been observed

worldwide (Klaserner, Popova, Gaudet, 2024). After cesarean section, studies and experiments have proven that the use of compression stockings, sequential mechanical compression devices, and various types and combinations of anticoagulants, including unfractionated heparin (UFH), fractionated heparin (FH), and low molecular weight heparin (LMWH), are effective preventive methods that have proven their efficiency in avoiding exposure to deep vein thrombosis, thus reducing morbidity and mortality rates among women during the postpartum period (Alalaf et al., 2015). The Norwegian Society of Obstetrics and Gynecology has advocated for the use of low-molecular-weight heparin as an anticoagulant after cesarean delivery for four to eight days. In the same vein, the Royal College of Obstetricians and Gynecologists (RCOG) has developed a three-stage classification for women who undergo cesarean delivery, recommending the prevention of deep vein thrombosis (DVT) for women at intermediate or high risk (Soliman et al., 2025). For patients who cannot be given anticoagulants to prevent thrombosis, alternatives such as venous filters can be used as a temporary preventative measure. In practice, inferior vena cava filters have been used and have shown high efficacy and a low risk of complications in preventing deep vein thrombosis in the lower extremities after childbirth. They have also proven effective antenatally for women with proximal vein thrombosis (Harris, Velineni, Davies, 2016). In 2016, the American College of Clinical Pharmacy published a set of treatment guidelines requiring patients with pulmonary thromboembolism or deep vein thrombosis (DVT), which is acquired as a complication of surgical procedures, to receive blood thinners for at least three months; these anticoagulants include rivaroxaban, dabigatran, edoxaban, or apixaban (Qureshi et al., 2024). Thrombolysis and pulmonary thromboaspiration are sometimes the most effective methods for saving the mother's life in the event of a massive thromboembolism. Pregnant women who suffer from this problem that leads to a disturbance in the blood circulation, in certain circumstances, find the traditional treatment strategy less effective, so more aggressive options are resorted to in order to preserve their lives (Qadri et al., 2025). Regarding increasing the risk of bleeding through the pregnancy period and puerperium, thrombolysis is deemed contraindicated during these times. However, over the past decade, advances have emerged in the treatment of vascular thrombosis using superficial percutaneous techniques using various types of anticoagulants. Meanwhile, other methods, which include puncturing the tear vessels to remove clots, whether alone or through the use of thrombolytic therapies, have been considered an effective postpartum treatment for deep vein thrombosis.

Conclusion

Various studies conducted on this topic have proven that deep vein thrombosis (DVT) and its complications, including

pulmonary thromboembolism (PTE), are a major cause of maternal mortality worldwide. Therefore, it is crucial to pay attention to this aspect to avoid any life-threatening danger. Furthermore, it has become clear that the incidence of venous thrombosis is higher in pregnant women. It has also been confirmed that women who undergo cesarean section are more likely to experience venous thrombosis as a complication of the surgical procedure if compared to those who deliver vaginally. As well as, some women who have risk factors predisposing them to DVT, whether in terms of race, age, weight, occupation, or genetics, are more likely to develop this condition. Therefore, it is the responsibility of doctors and nurses who monitor these cases to take these factors seriously to avoid any potential risks, as well as to adopt scientifically approved preventive and therapeutic methods for this condition.

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