Review Article

Thromboembolism in Pregnancy: Pathophysiological Insights, Diagnostic Challenges and Management Strategies in Low-Resource Settings

Abstract

One of the main causes of avoidable maternal fatalities worldwide, thromboembolism during pregnancy continues to be a significant contribution to morbidity and mortality. Pregnancy-related physiological changes, such as endothelial activation, venous stasis, and hypercoagulability, are intended to prevent hemorrhage after delivery. These same alterations, however, put expectant mothers at risk for venous thromboembolism (VTE), which includes pulmonary embolism (PE) and deep vein thrombosis (DVT). Due to diagnostic difficulties, inconsistent reporting, and inappropriate classification maternal mortality, the true burden of VTE in low- and middle-income countries (LMICs), particularly in sub-Saharan Africa, is underrecognized, despite the fact that its prevalence is believed to be 1-2 per 1000 pregnancies in high-income countries.

With a focus on situations with limited resources, this review summarizes the most recent findings about the pathophysiology, clinical implications, diagnostic difficulties, and therapeutic approaches of pregnancy-associated thromboembolism. In addition to new immunothrombotic and genetic pathways, we critically analyze the traditional framework of Virchow's triad, emphasizing the roles of thrombophilia, neutrophil extracellular traps, and systemic inflammation. Missed or delayed diagnoses are explored in relation to diagnostic difficulties in LMICs, such as limited availability to CT pulmonary angiography, Doppler ultrasonography, and standardized coagulation assays. In light of the restricted capability for laboratory monitoring, treatment strategies that focus on postpartum warfarin and low molecular weight heparin (LMWH) are examined.

The possibility of cutting-edge technologies including artificial intelligence (AI)-driven risk stratification, mobile health platforms, and solar-powered point-of-care coagulometers to revolutionize maternal VTE care is investigated. Creating genetic biobanks, longitudinal registries tailored to African contexts, and pregnancy-specific risk prediction tools are among the top research goals. In the end, reducing thromboembolic morbidity and mortality during pregnancy requires collaborative interdisciplinary efforts, tailored laboratory innovations, and enhanced maternal monitoring systems.

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Keywords: Hypercoagulability, Low molecular weight heparin, Low-resource settings, Maternal mortality, Nigeria, Pregnancy, Venous thromboembolism

Introduction

There are significant hematologic, vascular, and immunological changes that occur during pregnancy, making it a unique physiological state (Kazma et al., 2020). Most of these changes are protective, especially when it comes to lowering the risk of bleeding during and after childbirth. But they can unintentionally make people more vulnerable to thromboembolic problems. A major maternal health risk with potentially lethal consequences is thromboembolism, which is generally defined as the blockage of blood vessels by a clot that forms in situ(Payus et al., 2021) . Venous thromboembolism (VTE), which includes deep vein thrombosis (DVT) and pulmonary embolism (PE), is the most common form of thromboembolic disorder during pregnancy. Both conditions can result in rapid maternal collapse, long-term morbidity, and avoidable death(Maughan et al., 2022)

One of the main causes of maternal morbidity and mortality worldwide is VTE. In comparison to women who are not pregnant, the risk of VTE during pregnancy and the puerperium is roughly five to ten times higher (Maughan et al., 2022). In high-income environments, incidence rates are predicted to be 1-2 per 1000 deliveries . There is a very significant risk during the postpartum phase; population-based research suggests that the risk is almost 60 times greater than when not pregnant (Blondon & Skeith, 2022). Although these numbers are widely known in wealthy nations, diagnostic constraints, underreporting, and the frequent misclassification of maternal deaths make it difficult to determine the true burden in LMICs, such as Nigeria (Kokori et al., 2024; Oyston et al., 2017).

According to new data, thromboembolism plays a significant role in indirect maternal deaths in Nigeria, where maternal mortality is still among the highest in the world. Many cases of abrupt maternal collapse that are attributed to "cardiorespiratory failure" may actually be undiscovered as pulmonary emboli, according to retrospective research from tertiary centers (Akaba et al., 2021; Oladapo et al., 2015). Unrecognized VTE was shown to be a potential cause of over 10% of abrupt postpartum fatalities in a review conducted at the University of Nigeria Teaching Hospital (Khalifa & Nizam, 2023). Similar to this, findings from Northern Nigeria point to infection, extended immobilization, and cesarean birth as common but poorly understood causes for postpartum DVT. The undeveloped laboratory and imaging infrastructure across major part of the country further compound underdiagnosis and under-reported (Mojaddedi et al., 2024).

Pregnancy can be viewed as an acquired hypercoagulable condition from a pathophysiological perspective. The traditional foundation for comprehending pregnancy-associated venous thromboembolism (Kozak et al., 2025). Increases in fibrinogen and clotting factors VII, VIII, IX, and X, decreases in natural anticoagulants like protein S and antithrombin III, and decreased fibrinolysis are examples of physiological adaptations (Simioni et al., 2013).

Maternal morbidity and mortality are not the only effects of maternal VTE. According to Rodger, Saloojee, Wu, and Carrier . An underappreciated but important aspect of the public health impact in Nigeria is the psychosocial burden, which includes maternal worry, bereavement, and the financial pressure on families (Ajegbile, 2023; Erim et al., 2012).

Diagnosis is still a significant barrier. Without trimester-adjusted thresholds, biomarkers like D-dimer, while helpful in non-pregnant populations, lack specificity in pregnancy (Adeyeye et al., 2023; Edebiri & Áinle, 2022). Doppler ultrasonography, ventilation/perfusion scans, and CT pulmonary angiography—imaging modalities that are regarded as "gold standards" in high-income nations—are not always available in Nigerian hospitals and are mostly restricted to urban tertiary facilities(Orfanoudaki, 2019) . As a result, many deadly PE cases go unnoticed or are incorrectly classified. In order to close this gap, laboratory sciences are essential. When properly supported, assays including prothrombin time (PT), activated partial thromboplastin time (APTT), D-dimer, and thrombophilia genotyping provide insightful information for both diagnostic and therapeutic monitoring(Versteeg et al., 2013).

Management is just as difficult. Because it is safe and cannot pass through the placenta, low molecular weight heparin . However, its high cost, restricted availability, and absence of anti-Xa monitoring hinder its successful usage in Nigeria (Chawla, 2023). Despite being contraindicated during pregnancy, warfarin is nonetheless commonly taken after giving birth, but women who do not have proper INR monitoring run the risk of hemorrhaging and thrombosis . Although postpartum use of direct oral anticoagulants . These limitations in therapy emphasize how urgently context-specific solutions are needed(Gibson & Powrie, 2009; Olie et al., 2023)

In the future, creative approaches might close these gaps. Nigeria and other LMICs can benefit from solar-powered point-of-care coagulometers, mobile health platforms for anticoagulation monitoring, and artificial intelligence-driven decision support systems (Aifuobhokhan et al., 2025). Furthermore, identifying population-specific thrombophilia alleles and customizing therapies for Nigerian women may be made possible by translational genomic research and the creation of maternal health biobanks (John-Olabode et al., 2021).

In conclusion, pregnancy-related thromboembolism is a preventable but underrecognized risk in Nigeria. Diagnostic gaps, underfunded laboratory systems, and restricted access to evidence-based treatments all contribute to its burden. Better clinician vigilance, increased laboratory capacity, fair access to anticoagulants, and funding for translational research must be the top priorities of a Nigerian-centered approach. In order to inform focused prevention, diagnostic, and management initiatives, this review aims to emphasize the causes, effects, and solutions for PA-VTE by critically evaluating international research while placing it in the Nigerian context.

2.1 Aetiology and Pathophysiology of Thromboembolism in Pregnancy

Pregnancy-related thromboembolism has a complicated aetiology, involving intricate interactions between environmental, genetic, physiological, and biochemical variables. The main factor contributing to this risk is the pregnancy-induced hypercoagulable condition, which is a normal adaptation meant to reduce blood loss during childbirth but, ironically, makes women more vulnerable to venous thromboembolism (VTE) during the prenatal and postpartum phases (Dresang et al., 2023).

2.1.1 Physiological Adaptations

Pregnancy-related significant hematologic and hormonal changes encourage the formation of clots. These include increased expression of procoagulant factors

(Lockwood, 2006; Thornton & Douglas, 2010). Together, these changes satisfy Virchow's trinity of endothelial damage, venous stasis, and hypercoagulability, resulting in a physiologically adaptive but pathologically hazardous condition . Venous stasis, which is brought on by gravid uterine compression of the inferior vena cava, is most apparent in the third trimester, and endothelial damage usually follows obstetric interventions such as instrumentation or cesarean delivery (Archer, 2024).

2.1.2 Genetic and Molecular Determinants

Pregnancy-related significant hematologic and hormonal changes encourage the formation of clots. These include increased expression of procoagulant factors (Arias et al., 2019). Together, these changes satisfy Virchow's trinity of endothelial damage, venous stasis, and hypercoagulability, resulting in a physiologically adaptive but pathologically hazardous condition (Kozak et al., 2025). Venous stasis, which is brought on by gravid uterine compression of the inferior vena cava, is most apparent in the third trimester, and endothelial damage usually follows obstetric interventions such as instrumentation or cesarean delivery (Archer, 2024).

2.1.3 Biochemical Risk Modifiers

Thromboembolic risk is influenced by metabolic and biochemical abnormalities in addition to traditional coagulation mechanisms. Vascular inflammation, endothelial dysfunction, and oxidative stress are all facilitated by elevated plasma homocysteine. The need for nutritional and metabolic assessment in maternal thromboembolism risk profiling was emphasized in(Koklesová et al., 2021), who noted that hyperhomocysteinemia during pregnancy and postpartum significantly contributes to thrombus formation, especially in women who are genetically or clinically predisposed(Aday et al., 2021).

2.1.4 Context-Specific Risk Amplifiers in Nigeria

Other aspects of thromboembolic risk are introduced by the Nigerian setting. According to regional research, there are restrictions on using Euro-American laboratory reference standards to African populations because of trimester-dependent variations in platelet counts, clotting factor levels, and coagulation times . Risk is further increased by environmental factors such extended hospital immobility, restricted access to thromboprophylaxis, and high infection prevalence(Bates et al., 2018; Kozak et al., 2025) .

2.1.5 Integrated Pathophysiological Model

Modern research adds immunological and genetic components to the pathogenesis of pregnancy-associated VTE, even if Virchow's triad is still a classical framework. Increased inflammatory cytokines, altered endothelial function, and immunological tolerance mechanisms are all hallmarks of pregnancy, and they work in concert with hypercoagulability to raise the risk of thrombosis (AlSheef et al., 2022). Nigeria's disease landscape is particularly complex due to the interaction of acquired hypercoagulability, genetic thrombophilia, and context-specific variables such infections, cesarean sections, and inadequate laboratory infrastructure(Pusparini & Hidayat, 2020).

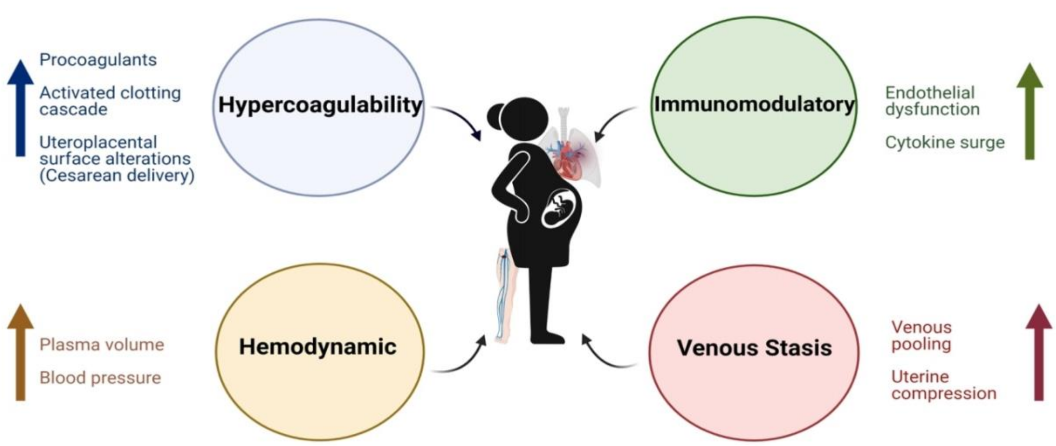

Figure 1: Pathophysiology of venous thromboembolism in pregnancy. Adapted from (Kozak et al., 2025).

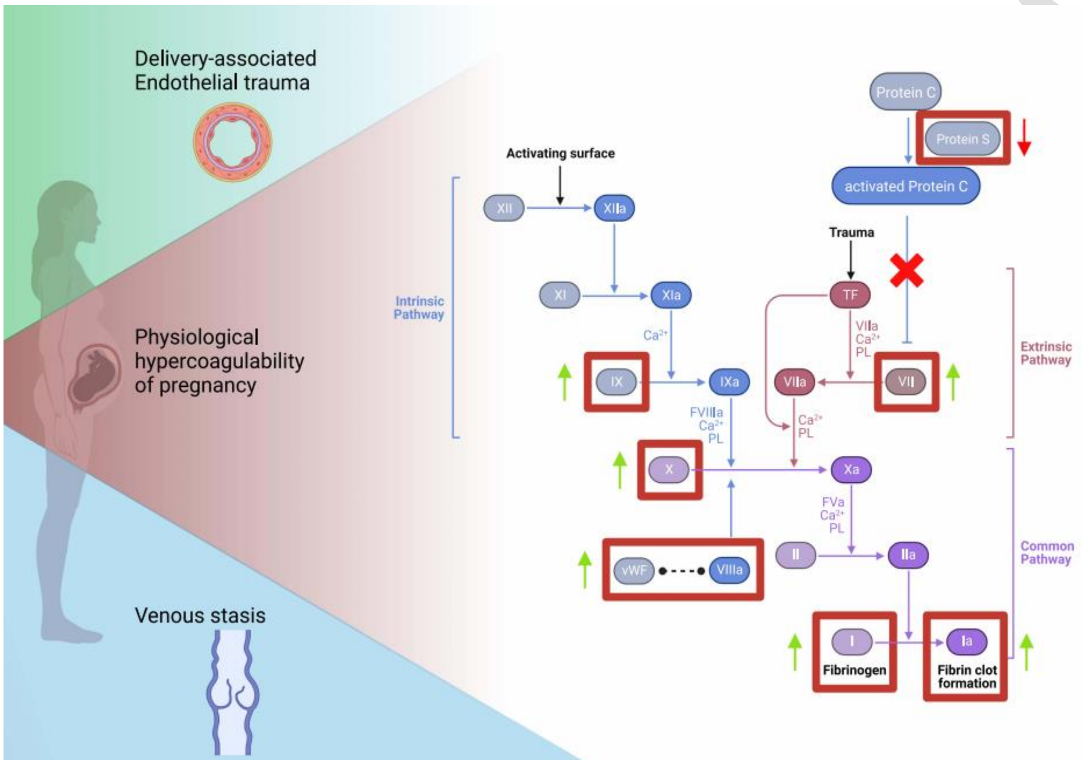

Figure 2: Convergence of Virchow's triad during pregnancy—endothelial trauma, venous stasis, and hypercoagulability—as well as postpartum. Coagulation is gradually activated to prepare the mother for delivery. Adapted from (Devis et al., 2017)

2.1.6 Implications for Prevention and Care

Prevention and treatment of thromboembolism in pregnancy are directly impacted by an understanding of its aetiology and pathophysiology. Laboratory surveillance, such as trimester-specific interpretation of D-dimer, prothrombin time (PT), and activated partial thromboplastin time (APTT), could enhance early diagnosis in Nigeria, where diagnostic facilities are scarce(Oyeleke et al., 2025). Additionally, context-sensitive prophylactic measures may be guided by focused screening for thrombophilia in high-risk groups (such as women with a history of repeated pregnancy loss, cesarean birth, or usage of hormonal contraceptives)(John-Olabode et al., 2021).

2.2 Hypercoagulability

It is commonly known that pregnancy causes hypercoagulation. While natural anticoagulants, especially protein S, are decreased, a number of procoagulant factors, such as factors I . Physiologic in late pregnancy, activated protein C . Procoagulant and anticoagulant forces are out of balance, creating a condition that is conducive to thrombosis(Kozak et al., 2025).

Normally between 2 and 4 g/L in non-pregnant women, fibrinogen concentrations rise to 4 to 6 g/L during pregnancy, especially during the third trimester (Simioni et al., 2013). This increase decreases fibrinolytic activity while increasing clot stability and hardness. In order to limit fibrinolysis, tissue plasminogen activator . When combined, these modifications produce an environment that increases the likelihood of thrombus development and decreases its likelihood of resolution(Tjärnlund-Wolf et al., 2012).

2.3 Venous Stasis

Pregnancy-related venous stasis is caused by both hormonal and mechanical causes. Particularly when supine, the enlarged uterus compresses the iliac and inferior vena cava veins, decreasing venous flow from the lower extremities(Kozak et al., 2025) . Venous dilatation and stasis are further facilitated by progesterone-mediated smooth muscle relaxation . Because the gravid uterus and the overlaying right iliac artery more often compress the left iliac vein, this explains why pregnancy-associated deep vein thrombosis (Kozak et al., 2025). Doppler studies of pregnant women have shown reduced venous flow velocity, with gradual slowing as gestation progresses . This stasis creates the conditions for the formation of a clot, particularly when paired with endothelial activation and hypercoagulability(Devis et al., 2017).

2.4 Endothelial Injury

Endothelial damage is a major factor in pregnancy-related thrombosis, but being less researched than hypercoagulability and stasis. Subendothelial collagen and tissue factor may be exposed by vascular trauma sustained during delivery, cesarean section, or instrumentation, which can encourage coagulation(Dresang et al., 2023) . Furthermore, endothelial dysfunction is exacerbated during pregnancy by oxidative stress and systemic inflammation. Endothelial activation is further aggravated by conditions like preeclampsia, which raises the expression of von Willebrand factor, tissue factor, and adhesion molecules(Adekola et al., 2014) .

2.5 Immunothrombosis and Inflammation

In addition to Virchow's triad, recent research emphasizes the role of immunothrombosis, a process in which coagulation is driven by innate immune responses. Activated neutrophils release neutrophil extracellular traps . Women with preeclampsia and VTE have been found to have higher levels of NET components, indicating a connection between inflammation and thrombosis (Branzk & Papayannopoulos, 2013).

2.6 Genetic and Thrombophilic Risk Factors

Although their prevalence varies by population, hereditary thrombophilias play a significant role in pregnancy-associated thrombosis. In sub-Saharan Africa, studies indicate that prothrombin G20210A and Factor V Leiden mutations are less common than in Caucasian populations, with other genetic factors like protein C, protein S, and antithrombin deficiencies playing a more significant role(Arias et al., 2019). The clinical significance of these genetic factors is increased in the presence of acquired risks like infections, prolonged immobility, cesarean section, and obesity . Genetic testing is still scarce in many African countries, underscoring the need for locally validated genomic studies(Crous-Bou et al., 2016).

2.7 Biomarkers of Thromboembolic Risk

The diagnostic and prognostic utility of laboratory biomarkers in pregnancy-associated VTE has been investigated. Due to physiologic changes during pregnancy, D-dimer, a fibrin breakdown product, is less specific than it is in non-pregnant people (Li et al., 2023). Trimester-specific reference ranges may increase diagnosis accuracy, according to recent research . Although they are still mostly limited to research settings, other interesting markers include platelet microparticles, soluble P-selectin, and thrombin-antithrombin complexes (Boij et al., 2012).

3.0 Clinical Burden and Outcomes

3.1 Maternal Outcomes

One of the main causes of maternal morbidity and mortality in the world is venous thromboembolism. Although better surveillance and prophylactic measures have reduced maternal mortality from VTE in high-income nations, the condition is still a major indirect cause of death (Kearsley & Stocks, 2021). Chronic thromboembolic pulmonary hypertension, post-thrombotic syndrome, and recurrent thrombosis are all linked to pregnancy-associated VTE .

Pregnant women who have experienced VTE in the past are also at an increased risk of recurrence, especially if they have thrombophilia(Devis & Knuttinen, 2017) .

3.2 Fetal and Neonatal Outcomes

These complications include intrauterine growth restriction. Research has indicated that maternal thrombophilias, particularly antiphospholipid syndrome, are associated with recurrent pregnancy loss and placental-mediated complications (Gibson & Powrie, 2009). Thromboembolism during pregnancy can impair uteroplacental perfusion, resulting in adverse fetal outcomes(Arias et al., 2019).

3.3 Psychosocial and Public Health Impact

Beyond just clinical morbidity, maternal thromboembolism has a significant psychosocial impact on families, causing them to experience anxiety, grief, and financial strain as a result of prolonged hospitalization or maternal death (Edebiri & Áinle, 2022). Maternal VTE also adds to the already fragile healthcare systems in LMICs, so investments in diagnostic infrastructure and preventative measures could have a high return on investment in maternal survival and socioeconomic stability(McLaren et al., 2017).

4.0 Diagnosis of Thromboembolism in Pregnancy

Due to clinical symptoms that overlap with those of a typical pregnancy and the fact that advanced diagnostic methods are sometimes unavailable in low-resource settings, diagnosing pregnancy-associated venous thromboembolism(Dresang et al., 2023).

4.1 Clinical Presentation

Unilateral leg swelling, discomfort, erythema, and tenderness are the clinical signs of DVT during pregnancy; these symptoms are most frequently seen in the left lower limb (Kalaitzopoulos et al., 2022). Though these symptoms are nonspecific and often coexist with pregnancy-related physiological changes including elevated respiratory rate and lower limb edema, pulmonary embolism might manifest as chest discomfort, dyspnea, tachycardia, or syncope (Righini et al., 2018). The sensitivity and specificity of clinical evaluation alone are diminished by this overlap. Pregnancy-specific validation is lacking for a number of risk assessment models, including the Wells score, which has been validated in non-pregnant populations. Although they have been suggested, modified clinical prediction algorithms that combine biomarkers and imaging are still not widely used in low-resource environments(Goodacre et al., 2018).

4.2 Laboratory Diagnostics

4.2.1 D-dimer Testing

According to studies, using trimester-specific reference ranges may improve diagnostic accuracy. A negative D-dimer combined with low clinical probability may safely exclude VTE in the first trimester but is unreliable later in pregnancy. D-dimer, a fibrin degradation product, is elevated in the majority of patients with acute VTE but also rises physiologically during pregnancy, limiting its specificity(Franchini et al., 2023; Mojaddedi et al., 2024) .

4.2.2 Coagulation and Thrombophilia Testing

Women at higher risk can be identified using thrombophilia panels, which include tests for protein C, protein S, antithrombin, and genetic variants like Factor V Leiden and Prothrombin G20210A. Interpretation is made more difficult by physiological decreases in protein S that occur during pregnancy. Due to restricted access to thrombophilia testing, clinical judgment is even more important in sub-Saharan Africa(Ormesher et al., 2017; Tsikouras et al., 2019).

4.3 Imaging Modalities

4.3.1 Compression Ultrasonography (CUS)

The first-line imaging technique for suspected pregnancy-related DVT is CUS of the lower extremities(Edebiri & Áinle, 2022).

4.3.2 Ventilation/Perfusion (V/Q) Scans

A V/Q scan is frequently chosen over CT pulmonary angiography for suspected PE since it exposes the mother's breast tissue to comparatively less radiation(Tromeur et al., 2018).

4.3.3 CT Pulmonary Angiography (CTPA)

Due to its excellent sensitivity and specificity, CTPA is becoming the gold standard for diagnosing PE . Modern low-dose regimens help to reduce concerns about radiation exposure to the fetus, although maternal breast exposure is still a major concern . Widespread use in LMICs is hampered by cost and accessibility(Mens et al., 2017).

4.3.4 Magnetic Resonance Imaging (MRI)

Although it is limited in terms of availability and expense, magnetic resonance venography provides excellent imaging of pelvic DVT without ionizing radiation (Mani et al., 2015).

4.4 Diagnostic Algorithms

The RCOG . Instead, guidelines recommend a structured diagnostic algorithm that combines risk stratification, D-dimer, and imaging(Dresang et al., 2023).

5.0 Management of Thromboembolism in Pregnancy

The management of PA-VTE necessitates taking into account drug safety profiles, monitoring feasibility, resource availability, and striking a balance between maternal safety and fetal well-being. Anticoagulation is the mainstay of treatment, with supportive treatments and, in certain situations, invasive therapies added (Kearsley & Stocks, 2021).

5.1 Anticoagulant Therapy

5.1.1 Low Molecular Weight Heparin (LMWH)

Because of its predictable pharmacokinetics, decreased risk of heparin-induced thrombocytopenia. Using anti-Xa tests, the dosage is weight-adjusted, and monitoring is typically not required in low-risk patients but advised in high-risk women. Due to restricted access to anti-Xa tests, fixed-dose regimens are necessary in LMICs, which raises concerns regarding either too much or too little treatment(Sikes et al., 2023).

5.1.2 Unfractionated Heparin (UFH)

When quick reversal is needed (Amarin & Abduljabbar, 2020).

5.1.3 Vitamin K Antagonists (Warfarin)

Because warfarin is teratogenic and crosses the placenta, it should not be used during pregnancy, particularly during the first trimester. Nonetheless, it is frequently used for prolonged anticoagulation throughout the postpartum phase. Safe usage in low-resource settings is restricted by the need for routine international normalized ratio (Sanches et al., 2020).

5.1.4 Direct Oral Anticoagulants (DOACs)

Related to inadequate safety data, DOACs like rivaroxaban and apixaban are not advised during pregnancy . Postpartum use is feasible, but there are obstacles related to cost and a shortage of reversal agents in LMICs(Sessa et al., 2019).

5.2 Mechanical and Interventional Therapies

In certain situations, women who are contraindicated for anticoagulation or who continue to experience VTE after treatment may be candidates for inferior vena cava. Although thrombolysis or surgical embolectomy can save lives in cases of major PE, they are rarely practical in LMICs and carry a high risk of maternal hemorrhage (Marfil-Rivera, 2019).

5.3 Prophylaxis

According to the Royal College of Obstetricians and Gynecologists [RCOG], 2015, thromboprophylaxis is crucial for high-risk pregnancies, such as those with women who have had previous VTE, thrombophilia, obesity, cesarean birth, or extended immobilization. The recommended course of treatment is LMWH, which is usually taken for at least six weeks after delivery. However, prophylaxis is not always applied in LMICs because of the high cost of drugs, low awareness, and a lack of dissemination of guidelines (Tomkowski et al., 2017).

5.4 Monitoring and Challenges in LMICs

Anticoagulation monitoring requires a lot of resources. Nigeria and similar countries frequently lack dependable laboratory infrastructure, which is necessary for anti-Xa tests for LMWH and INR for warfarin. Although there is little evidence of their effectiveness during pregnancy, point-of-care coagulometers are a viable option (Sikes et al., 2023).

5.5 Global Guidelines versus African Context

Detailed diagnosis and management recommendations are provided by the American College of Obstetricians and Gynecologists (Bates et al., 2018; Edebiri & Áinle, 2022). However, these guidelines assume that imaging, laboratory monitoring, and anticoagulants are available, which may not reflect the situation in LMICs. There is an urgent need for local adaptations, such as simplified clinical algorithms, task-shifting to mid-level providers, and government-subsidized LMWH (Streiff et al., 2016).

6. 0 Future Research Directions

Despite significant advancements in our understanding of pregnancy-associated thromboembolism (PA-VTE), there are still a number of knowledge and practice gaps, especially in low- and middle-income (LMIC) nations. It is necessary to combine point-of-care technologies, genetic research, laboratory improvements, and health systems strengthening in order to close these gaps (O'Rourke et al., 2024).

6.1 Pregnancy-Specific Risk Stratification Tools

Although well-validated in non-pregnant populations, risk assessment methods like the Wells score are inaccurate in pregnant women (Hameed et al., 2024).

6.2 Translational Genomics and Biobanking

The establishment of genomic biobanks in Nigeria and sub-Saharan Africa would facilitate the identification of population-specific thrombophilia alleles, facilitating precision medicine approaches (Miceli et al., 2025). Integration with maternal health registries could help link genetic risk to clinical outcomes. Genetic predispositions, such as Factor V Leiden and Prothrombin G20210A mutations, are well-characterized in European populations but remain poorly studied in African women, where other polymorphisms may play greater roles (John-Olabode et al., 2021).

6.3 Point-of-Care Technologies

The lack of laboratory infrastructure that hinders safe management of PA-VTE in LMICs may be addressed by point-of-care(Colucci & Tsakiris, 2020) ; solar-powered devices and Bluetooth-enabled platforms could improve accessibility in rural areas; and rigorous validation in pregnant women is necessary to ensure reliability (Price et al., 2020).

6.4 Longitudinal Cohorts and Registries

In Africa, large-scale prospective maternal cohorts are still in their infancy. Critical information on the prevalence, risk factors, and consequences of PA-VTE may be obtained from such cohorts. Registries like the UK Obstetric Surveillance System . Similar programs in Nigeria could record real-world maternal and perinatal outcomes, influence policy, and inform targeted interventions(Kokori et al., 2024).

6.5 Artificial Intelligence and Decision Support Systems

By offering real-time decision support, artificial intelligence . Frontline healthcare workers in rural Africa may have more access thanks to mobile applications connected to AI algorithms. Equity in digital access, local validation, and algorithm transparency are still issues, though(Lima et al., 2025).

7.0 Discussion

Pregnancy-associated thromboembolism is still a leading, but preventable, cause of maternal morbidity and mortality globally. Although surveillance, diagnosis, and treatment have improved in high-income nations, structural impediments still result in a disproportionately high burden in LMICs.

7.1 Global versus Regional Perspectives

The Royal College of Obstetricians and Gynecologists [RCOG], 2015 states that routine use of LMWH prophylaxis, access to imaging modalities, and structured diagnostic algorithms have significantly decreased maternal deaths from VTE in high-resource settings(Amarin & Alfaqih, 2020). In contrast, in Nigeria and many other African countries, prophylaxis is applied inconsistently, anticoagulant monitoring is limited, and clinical suspicion frequently replaces confirmatory testing (Ogunlaja et al., 2020). This discrepancy highlights the significance of context-sensitive adaptation of international guidelines.

7.2 Diagnostic Innovations

The development of pregnancy-adjusted diagnostic algorithms such as the YEARS model illustrates that personalized techniques can eliminate needless imaging without compromising safety(Wiles et al., 2022) . Extending such validation to African populations, where baseline D-dimer levels may differ due to high prevalence of chronic infections, is crucial. Investing in reasonably priced POC testing could close current diagnostic gaps (Fan et al., 2023).

7.3 Therapeutic Challenges

LMWH is the safest and most effective drug in the world, but its continuous usage in LMICs is limited by its cost, requirement for daily injections, and inadequate monitoring capability. Warfarin is still often used after giving birth, however risks are increased by inadequate INR monitoring(Semakula et al., 2020) . To enhance therapeutic results, policymakers should give priority to LMWH subsidies, laboratory capacity expansion, and healthcare worker training(DeLoughery & Bannow, 2022).

7.4 Knowledge Gaps and Research Priorities

There are still important unanswered questions regarding the prevalence and genetic causes of PA-VTE in African populations. Biobank projects and extensive cohort studies would yield vital information. In addition, not much research has examined the psychological effects of maternal VTE, which needs to be investigated in order to fully represent the disease's burden (Edebiri & Áinle, 2022).

8.0 Conclusion

Pregnancy-related thromboembolism is a prime example of how pathological risk, physiological adaptability, and systemic health inequities interact. Even while our understanding of the pathophysiological pathways is growing, we still haven't fully translated this understanding into fair therapeutic practice. Although LMWH is still the cornerstone of management, infrastructure and financial constraints prevent its full implementation in LMICs. Future advancements in maternity care systems depend on the incorporation of AI-powered decision assistance, POC technologies, translational genomics, and diagnostic advances. Improving maternity surveillance, setting up registries, and funding laboratory facilities are crucial actions for Nigeria and sub-Saharan Africa. Reducing avoidable maternal mortality from thromboembolism during pregnancy will need interdisciplinary cooperation between obstetricians, hematologists, laboratory scientists, and legislators.

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