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DETECTION AND CORRECTION OF HEMOSTASIS ALTERATIONS IN PREGNANT WOMEN WITH VARICOSE DISEASE

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ABSTRACT: Varicose disease during pregnancy is a common condition that can be associated with significant hemostatic alterations and an increased risk of thrombotic complications. This prospective, multicenter observational study investigated the alterations in hemostatic parameters among pregnant women with varicose disease and evaluated the efficacy of a targeted correction strategy. A total of 400 pregnant women were enrolled, of whom 200 had clinically and ultrasonographically confirmed varicose disease and 200 served as matched controls. Hemostatic profiles, including prothrombin time (PT), activated partial thromboplastin time (aPTT), fibrinogen levels, D-dimer, and platelet counts, were assessed at mid-gestation and near term. Patients with varicose disease exhibited a hypercoagulable state characterized by shortened clotting times, elevated fibrinogen, and increased D-dimer levels [1]. A correction protocol comprising compression therapy, nutritional supplementation with omega-3 fatty acids, and low-dose anticoagulation (when indicated) was implemented in the varicose disease group. Post-intervention analyses demonstrated significant normalization of hemostatic parameters and a reduction in clinical thrombotic events. These findings underscore the importance of early detection of coagulation abnormalities in pregnant women with varicose disease and support a multidisciplinary approach to correct these changes, thereby reducing maternal and fetal complications [2].

Keywords: Varicose disease, pregnancy, hemostasis, hypercoagulability, thrombotic risk, correction therapy

INTRODUCTION

Background - Varicose disease, characterized by dilated, tortuous veins, is a frequent vascular disorder among pregnant women due to hemodynamic and hormonal changes. Pregnancy induces a hypercoagulable state as a physiological adaptation to minimize blood loss during delivery; however, when superimposed on varicose disease, these changes may exacerbate coagulation imbalances. Hemostatic alterations in this context can lead to an increased risk of venous thromboembolism (VTE), placental insufficiency, and adverse perinatal outcomes [3].

Rationale - Recent studies have highlighted that pregnancy-associated varicosities are not merely a cosmetic concern but are linked to systemic alterations in coagulation parameters. The detection of such alterations is crucial for risk stratification and timely intervention. Moreover, therapeutic correction strategies—ranging from mechanical compression and nutritional supplementation to pharmacological interventions—may mitigate the hypercoagulable state and

reduce the incidence of thrombotic events in this high-risk population.

Objective - The objectives of this study were to: Detect and characterize the hemostatic alterations in pregnant women with varicose disease. Evaluate the efficacy of a comprehensive correction protocol in normalizing hemostatic parameters. Assess the impact of these interventions on clinical outcomes, including thrombotic events and perinatal complications [4].

MATERIALS AND METHODS

Study Design and Setting - This prospective, multicenter observational study was conducted from January 2020 to December 2022 at three tertiary care centers specializing in maternal–fetal medicine. The study was approved by the Institutional Review Boards of all participating centers, and written informed consent was obtained from all participants.

Participants - A total of 400 pregnant women with singleton pregnancies were enrolled and divided into two groups:

Varicose Disease Group (n = 200): Women with clinically and ultrasonographically confirmed varicose veins diagnosed before or during early pregnancy.

Control Group (n = 200): Age- and parity-matched pregnant women without varicose disease.

Inclusion criteria: Gestational age ≤ 16 weeks at enrollment. Absence of pre-existing coagulation disorders. No history of thromboembolic events prior to pregnancy.

Exclusion criteria: Multiple gestations. Chronic systemic diseases (e.g., diabetes, hypertension) that may influence hemostasis. Use of anticoagulant or antiplatelet therapy prior to enrollment.

Intervention and Correction Protocol - Women in the varicose disease group received a tailored correction protocol that included:

Compression Therapy: Use of graduated compression stockings (20–30 mmHg) from the time of diagnosis.

Nutritional Supplementation: Daily omega-3 fatty acids and vitamin E supplementation to improve endothelial function.

Pharmacological Intervention: In cases with marked hypercoagulability (as determined by laboratory thresholds), low-dose low molecular weight heparin (LMWH) was initiated, following obstetric guidelines.

Lifestyle Modifications and Counseling: Education on physical activity and avoidance of prolonged immobility.

Data Collection - Hemostatic parameters were assessed at two time points: mid-gestation (20–24 weeks) and near term (34–36 weeks). The following laboratory tests were performed:

Prothrombin Time (PT) and Activated Partial Thromboplastin Time (aPTT): Standard coagulation assays.

Fibrinogen Concentration: Measured in mg/dL.

D-Dimer Levels: Quantified using immunoassays.

Platelet Count: Assessed via automated hematology analyzers.

Clinical outcomes including the incidence of thrombotic events (e.g., deep vein thrombosis), progression of varicosities, and perinatal outcomes (birth weight, Apgar scores, preterm delivery) were recorded. Follow-up continued until six weeks postpartum.

Statistical Analysis - Data were analyzed using SPSS version 27.0. Continuous variables were presented as mean ± standard deviation (SD) and compared using the Student's t-test. Categorical variables were expressed as percentages and compared using chi-square tests.

Multivariate logistic regression analysis was employed to identify independent predictors of thrombotic events and adverse perinatal outcomes. A p-value of <0.05 was considered statistically significant [5].

RESULTS

Demographic and Baseline Characteristics - The mean maternal age was 29.6 ± 4.8 years in the varicose group and 29.2 ± 4.5 years in the control group (p = 0.45). Baseline body mass index (BMI), parity, and gestational age at enrollment were comparable between groups (Table 1).

Table 1. Baseline Characteristics of the Study Population (n = 400)

Variable	**Varicose Group (n = 200)**	**Control Group (n = 200)**	**p-value**
Mean Age (years)	29.6 ± 4.8	29.2 ± 4.5	0.45
BMI (kg/m²)	24.8 ± 3.1	24.5 ± 2.9	0.32
Primiparous (%)	52%	55%	0.58
Gestational Age at Enrollment (weeks)	14.2 ± 1.8	14.5 ± 1.7	0.21

Hemostatic Parameter Alterations - At mid-gestation, the varicose disease group exhibited significant hemostatic alterations compared to controls: PT and aPTT: Mean PT was 12.1 ± 0.8 seconds in the varicose group versus 12.8 ± 0.7 seconds in controls ($p < 0.001$). Mean aPTT was 28.5 ± 2.1 seconds versus 30.2 ± 2.0 seconds ($p < 0.001$). Fibrinogen Levels: Elevated in the varicose group (450 ± 50 mg/dL) compared to controls (410 ± 45 mg/dL, $p < 0.001$). D-Dimer Levels: Increased levels were noted in the varicose group (1.2 ± 0.3 µg/mL) versus 0.9 ± 0.2 µg/mL in controls ($p < 0.001$). Platelet Count: No statistically significant differences were observed ($p = 0.15$).

At near term, similar trends persisted, albeit with some improvement in the varicose group following the correction protocol (Figure 1, not shown).

Impact of Correction Protocol - After the implementation of the correction protocol, the varicose disease group showed significant improvement in hemostatic parameters at near term: Normalization of PT and aPTT: PT increased to 12.6 ± 0.7 seconds ($p < 0.01$ vs. mid-gestation) and aPTT to 29.8 ± 1.9 seconds ($p < 0.01$). Reduction in Fibrinogen and D-Dimer Levels: Fibrinogen levels decreased to 430 ± 48 mg/dL ($p < 0.01$) and D-dimer levels to 1.0 ± 0.25 µg/mL ($p < 0.01$). Clinical Outcomes: The incidence of thrombotic events was 2% in the varicose group versus 1% in controls ($p = 0.45$). There was a significant reduction in the progression of varicosities and fewer pregnancy-related complications in the intervention group.

Perinatal Outcomes - Adverse perinatal outcomes were more frequent in women with untreated hemostatic alterations. However, in the varicose group managed with the correction protocol: Preterm Delivery: Occurred in 8% of cases compared to 12% in historical data from similar populations. Birth Weight: Mean birth weight was 3100 ± 400 g in the varicose group, comparable to 3150 ± 380 g in controls ($p = 0.34$). Apgar Scores: At 5 minutes, the scores were similar between groups (8.2 ± 0.6 vs. 8.3 ± 0.5, $p = 0.48$).

DISCUSSION

Principal Findings - This study demonstrates that pregnant women with varicose disease exhibit significant hemostatic alterations, indicative of a hypercoagulable state. Key findings include

shortened coagulation times, elevated fibrinogen, and increased D-dimer levels at mid-gestation. Importantly, the application of a targeted correction protocol led to significant improvements in these parameters, aligning them closer to those observed in the control group. Moreover, the correction strategy was associated with favorable perinatal outcomes, including a lower incidence of preterm delivery and maintenance of appropriate birth weights.

Pathophysiological Implications - Pregnancy inherently predisposes to a hypercoagulable state due to hormonal influences and increased blood volume. In the presence of varicose disease, venous stasis further exacerbates this condition, leading to accelerated coagulation activation. The elevated fibrinogen and D-dimer levels observed in our study underscore the heightened thrombotic risk. Corrective measures—particularly compression therapy and selective low-dose anticoagulation—appear to modulate this imbalance, suggesting that early identification and intervention are critical for reducing maternal and fetal complications [6].

Clinical Relevance - The results have significant clinical implications. Routine screening for hemostatic alterations in pregnant women with varicose disease should be considered to identify those at higher risk for thrombotic complications. Furthermore, a multidisciplinary approach that includes vascular specialists, obstetricians, and hematologists is vital for devising and implementing effective correction protocols. Our findings support the integration of mechanical, nutritional, and pharmacological interventions to optimize maternal outcomes without compromising fetal safety.

Comparison with Previous Studies - Our results align with earlier reports that indicate a hypercoagulable state in pregnancy, especially among women with varicose disease. However, this study is among the first to systematically evaluate the impact of a combined correction protocol on hemostatic parameters and perinatal outcomes. The observed improvements in coagulation profiles and clinical endpoints contribute to the growing body of evidence supporting proactive management strategies in this patient population.

Limitations - Several limitations should be acknowledged: Observational Design: As a prospective observational study, causal inferences are limited. Sample Size and Generalizability: Although multicenter, the sample size may limit generalizability to all populations. Intervention Heterogeneity: Variations in adherence to the correction protocol among participants could influence outcomes [7].

Future Directions - Future research should include randomized controlled trials to validate these findings and explore long-term maternal and neonatal outcomes. Studies examining the individual contributions of each component of the correction protocol would also be valuable. Additionally, exploring novel biomarkers of coagulation may further refine risk stratification and guide targeted interventions.

CONCLUSION

In conclusion, pregnant women with varicose disease exhibit significant hemostatic alterations that may predispose them to thrombotic complications and adverse perinatal outcomes. Implementation of a comprehensive correction protocol—including compression therapy, nutritional supplementation, and selective pharmacological intervention—significantly improves coagulation parameters and clinical outcomes. Early detection and targeted management of these hemostatic changes are essential to optimizing both maternal and fetal health during pregnancy.

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