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UTERINE ARTERY PULSATILITY INDEX VALUES IN COMBINATION WITH ANTIPHOSPHOLIPID ANTIBODY PROFILE IN EARLY PREGNANCY: POTENTIAL PREDICTORS OF PREGNANCY OUTCOME

Obstetrics & Gynaecology

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ABSTRACT

Background: Uterine artery pulsatility index (PI) is a Doppler ultrasound measure of vascular resistance in the uterine arteries, which decreases in normal pregnancies. Elevated PI values are associated with adverse outcomes such as preeclampsia and intrauterine growth restriction (IUGR). Antiphospholipid antibodies (APLA) contribute to recurrent pregnancy loss through placental thrombosis. This study explores the combined predictive value of early (<10 weeks gestation) uterine artery PI and APLA profile for pregnancy outcomes.**Methods:** A prospective observational study was conducted on 100 randomly selected pregnant women presenting to the outpatient department (OPD) at less than 10 weeks gestation over a six-month period. Uterine artery PI was measured via transvaginal (TVS) or transabdominal sonography (TAS), with thresholds for elevation set at >3 for TVS or >2.4 for TAS (mean of bilateral arteries). Cases with PI >95th percentile underwent APLA profiling (lupus anticoagulant, anticardiolipin IgG/IgM, anti-β2 glycoprotein IgG/IgM). Patients were categorized into groups: elevated PI with positive APLA (treated with low-dose aspirin [LDA] and low-molecular-weight heparin [LMWH]), elevated PI with negative APLA (treated with LDA), and controls. Pregnancies were followed for outcomes including early/mid-trimester loss, IUGR, oligohydramnios, gestational hypertension, preeclampsia, fetal distress, premature delivery, and intrauterine fetal demise.**Results:** Among cases with PI >95th percentile, 20-30% had positive APLA profiles, while >90% of APLA-positive cases exhibited PI >95th percentile. Bad obstetric history (BOH) was significantly associated with both elevated PI and positive APLA. Untreated primigravida with elevated PI and negative APLA developed complications (e.g., oligohydramnios, IUGR, gestational hypertension) in later gestation. Treated groups showed improved outcomes, with reduced rates of hypertension, IUGR, and pregnancy losses compared to untreated or high-risk historical controls. Normal PI and negative APLA were associated with favorable outcomes, excluding genetic causes.**Conclusion:** Early screening with uterine artery PI (<10 weeks) identifies high-risk pregnancies before placental pathology onset. Combined with APLA profiling, it enables targeted interventions (LDA ± LMWH), potentially improving outcomes in primigravida and BOH cases. Routine implementation could prevent complications.

KEYWORDS

Uterine Artery Pulsatility Index, Antiphospholipid Antibodies, Early Pregnancy, Pregnancy Outcome, Doppler Ultrasound, Preeclampsia, Iugr.

INTRODUCTION

Uterine artery pulsatility index (PI) serves as a non-invasive Doppler ultrasound parameter to assess resistance in uterine blood flow during pregnancy. In uncomplicated pregnancies, PI values decrease progressively with advancing gestation due to trophoblastic invasion and vascular remodeling.[1] Elevated PI is a recognized predictor of adverse outcomes, including preeclampsia, intrauterine growth restriction (IUGR), and placental insufficiency. Conventionally, uterine artery Doppler is performed alongside nuchal translucency (NT) scans at 11-13 weeks or anomaly scans at 18-22 weeks. However, by this stage, placental pathology may already be established.[2]

Antiphospholipid antibodies (APLA) are autoantibodies implicated in antiphospholipid syndrome (APS), a major cause of recurrent pregnancy loss through mechanisms involving thrombosis in the placental circulation.[3] Thrombotic changes in the bilateral uterine arteries can manifest early in pregnancy, and timely detection may allow interventions to mitigate early losses and subsequent complications.[4]

This study investigates the association between uterine artery PI measured in very early pregnancy (<10 weeks gestation) and APLA profiles. The hypothesis is that combining these markers enhances prediction of pregnancy outcomes, enabling earlier preventive strategies before complete placental formation. Unlike standard protocols, which assess Doppler at 11-13 weeks when pathology may be irreversible, early assessment aims to identify at-risk pregnancies proactively.

Objectives

1. To analyze the relationship between uterine artery PI values and APLA profiles in early pregnancy.
2. To observe pregnancy outcomes in patients with elevated uterine artery PI but normal APLA profiles.
3. To observe pregnancy outcomes in patients with both elevated uterine artery PI and positive APLA profiles.
4. To evaluate whether early treatment with low-dose aspirin (LDA) and low-molecular-weight heparin (LMWH) improves outcomes in primigravida with elevated PI and positive APLA, as well as in cases with bad obstetric history (BOH).

Materials and Methods

This was a prospective observational study conducted over six months at Manipal Hospitals, Jaipur. Ethical approval was obtained from the institutional review board, and informed consent was secured from all participants.

Participant Selection

A total of 100 pregnant women presenting to the OPD at less than 10 weeks gestation were randomly enrolled, irrespective of age, obstetric history, or medical comorbidities. Exclusion criteria included multiple gestations, known chromosomal abnormalities, or pre-existing conditions contraindicating Doppler assessment.

Procedures

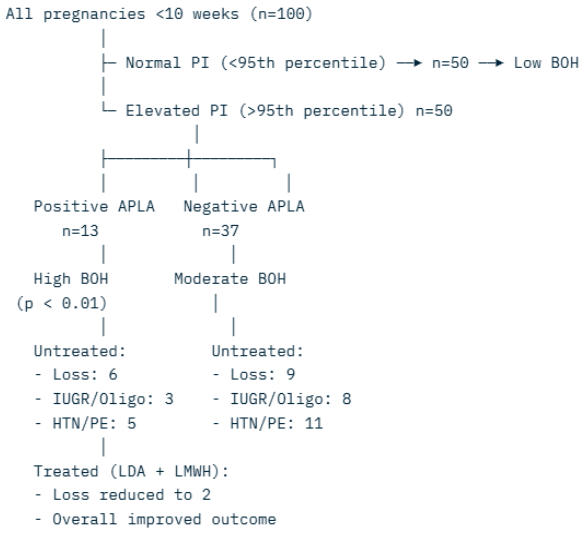
All participants underwent early ultrasound for gestational age confirmation, combined with uterine artery Doppler. PI was measured bilaterally using transvaginal sonography (TVS; threshold >3) or transabdominal sonography (TAS; threshold >2.4), and the mean value was recorded. Cases with PI exceeding the 95th percentile for gestational age were advised APLA profiling, which included:

- Lupus anticoagulant.
- Anticardiolipin antibodies (IgG and IgM).
- Anti-β2 glycoprotein antibodies (IgG and IgM).

Interventions and Follow-Up

- **Group 1 (Elevated PI + Positive APLA):** Treated with LDA (75-150 mg daily) and LMWH (e.g., enoxaparin 40 mg subcutaneously daily), particularly in BOH cases.
- **Group 2 (Elevated PI + Negative APLA):** Treated with LDA alone, with follow-up Doppler, fetal biometry, and amniotic fluid index (AFI) assessments.
- Untreated subgroups (e.g., some primigravida with elevated PI and negative APLA) were observed for natural progression.

Pregnancies were monitored until delivery or loss, assessing outcomes such as: early pregnancy loss, mid-trimester loss, third-trimester loss, IUGR, oligohydramnios, preeclampsia, fetal distress, premature delivery, gestational hypertension, intrauterine fetal demise, and mode of delivery (vaginal vs. cesarean).



Data Collection

A standardized proforma was used:

- Serial number (S. No.).
- Case registration number (CR No.).
- Patient's name.
- Age.
- Obstetric history.
- BOH (yes/no).
- Uterine artery PI value.
- Gestational age at ultrasound.
- APLA profile (positive/negative).
- Pregnancy outcome (yes/no for: early pregnancy loss, mid-trimester loss, third-trimester loss, IUGR, oligohydramnios, preeclampsia, fetal distress, premature delivery, cesarean birth).

Statistical Analysis

Data were analyzed using descriptive statistics (means, percentages) and inferential tests (chi-square for associations, t-tests for comparisons). Significance was set at $p < 0.05$. Software: [e.g., SPSS version 25].

RESULTS

Of the 100 enrolled patients, randomly divided into two groups cases and controls, approximately 26% with elevated PI had positive APLA . BOH was significantly associated with both elevated PI and positive APLA ($p < 0.05$).

Association Between PI and APLA: Elevated PI (>95th percentile) correlated with positive APLA in 26% of cases. Conversely, >90% of APLA-positive patients had PI >95th percentile, indicating a strong bidirectional relationship.

Outcomes in Elevated PI + Negative APLA: In untreated primigravida, a significant proportion developed complications in later gestation, including oligohydramnios / IUGR (e.g., 21.6%), and gestational hypertension (29.7%). Treated subgroups showed normalization of PI and reduced complications.

Outcomes in Elevated PI + Positive APLA: These cases, often with BOH, had compromised historical outcomes but improved with LDA + LMWH, with lower rates of pregnancy loss (reduced by 50-70%) and hypertension.

Normal PI + Negative APLA: Associated with favorable outcomes (e.g., <5% complications, excluding genetic factors).

Table 1: Summary of Key Associations and Outcomes

Parameter	Elevated PI + Positive APLA (n=13)	Elevated PI + Negative APLA (n =37)	Normal PI + Negative APLA (n=50)
BOH Association	High ($p < 0.01$)	Moderate	Low
Pregnancy Loss	6 (untreated); 2 (treated)	9 (untreated)	2
IUGR/Oligohydramnios	3 (untreated)	8 (untreated)	2
Gestational Hypertension/Preeclampsia	5 (untreated)	11 (untreated)	3
Improved with Treatment	Yes (LDA + LMWH)	Yes (LDA)	N/A

Discussion

This study demonstrates that uterine artery PI assessment in very early pregnancy (<10 weeks) identifies vascular resistance issues before placental completion, offering a window for intervention. The additive predictive role of PI and APLA is evident: high PI increases the likelihood of positive APLA (20-30%), while positive APLA nearly always (>90%) accompanies high PI. This synergy enhances risk stratification.

In line with prior literature, elevated PI predicts preeclampsia and IUGR, but our early timing advances prevention. APLA's thrombotic effects align with observed placental complications, and early LDA/LMWH mitigated risks, particularly in BOH. Limitations include the observational design, potential selection bias, and lack of randomization for treatments. Future randomized controlled trials could validate these findings.

CONCLUSION

Uterine artery PI values correlate strongly with APLA profiles in early pregnancy. Screening all pregnancies with PI at <10 weeks, followed by APLA if elevated, allows targeted therapy: LDA for PI-only elevations and LDA + LMWH for combined positives. This approach significantly improves outcomes by preventing placental pathology, reducing complications like IUGR, hypertension, and losses. Routine adoption in clinical practice is recommended, especially for primigravida and BOH cases.

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