



COMPARING PLACENTAL POSITION AND UTERINE ARTERY DOPPLER AS PREDICTORS OF PREGNANCY INDUCED HYPERTENSION: PROSPECTIVE STUDY

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ABSTRACT

This study explores the relationship between placental location, uterine artery Doppler findings in the second trimester, and the incidence of pregnancy-induced hypertension (PIH) among antenatal patients at Vijaya Hospital, Chennai. A cohort of 240 patients was analyzed, with data collected on placental positioning, Doppler readings, and PIH outcomes. Findings indicate that lateral (abnormal) placental location significantly increases PIH risk compared to central (normal) placement (52% vs. 16.74%, $p < 0.0001$). Abnormal uterine artery Doppler results also correlate strongly with PIH (73.07% vs. 14.01%, $p < 0.0001$). Patients with both lateral placental location and abnormal Doppler findings showed a 100% incidence of PIH. These results highlight the importance of combined placental and Doppler assessments to identify high-risk pregnancies early, allowing for targeted management and improved outcomes.

KEYWORDS : Pregnancy-induced hypertension, placental location, uterine artery Doppler, second trimester ultrasound, antenatal risk factors

INTRODUCTION

Hypertensive disorders of pregnancy remain among the most significant and intriguing unsolved problem in obstetrics, affecting 5% to 10% of all gestations(1), (2). Approximately 1/4th of hypertensive disorders in pregnancy are due to chronic hypertension and 3/4th is due to gestational hypertension and pre-eclampsia. Pre-eclampsia and eclampsia is one of the major cause of maternal mortality and morbidity worldwide.(3) Hence hypertensive disorders of pregnancy should be identified early and intervened.

Hypertension in pregnancy is defined as a systolic BP of ≥ 140 mmHg and/or diastolic BP ≥ 90 mmHg on two occasions at least 15 minutes apart without proteinuria, signs and symptoms of eclampsia.(4) There are various screening methods available to predict pre-eclampsia like Soluble fms-like tyrosine kinase 1(sFlt-1): PIGF ratio (5), serum markers such as PAPP-A and uterine artery doppler (6) Localisation of placenta in antenatal ultrasonography (7).

Placental location has been found to correlate with the presence of Pre-eclampsia and adverse pregnancy outcome(7).Placenta can be centrally or laterally located. In centrally located placenta, blood flow is met by bilateral uterine arteries. In laterally located placenta, the utero-placental blood flow is primarily met by the ipsilateral uterine artery with some collateral circulation from the contralateral uterine artery. This collateral contribution may be deficient in some individuals facilitating development of pre-eclampsia (8).

Ultrasonography done in second trimester can be used to identify localization of the placenta and can be used to determine blood flow in bilateral uterine arteries. Resistance in uteroplacental flow assessed by uterine artery doppler by measuring either pulsatility index, resistance index, systolic/diastolic ratio and presence of any diastolic notch(9).

The purpose of this study was to detect the correlation between the placental localization and abnormal uterine artery doppler findings in the second trimester ultrasonography, either individually or combined, and the incidence of pregnancy induced hypertension in patients

AIM OF STUDY

To determine the association between the placental position, uterine artery doppler or both and pregnancy induced hypertension.

MATERIALS AND METHODS

This prospective observational study was conducted in the Department of Obstetrics and Gynecology at Vijaya Hospital, Chennai, from January 2023 to November 2023. The study focused on a population of antenatal patients who were selected based on predefined inclusion and exclusion criteria. A sample size of 240 participants was chosen, determined by the known incidence rate referenced from previous studies and in-hospital data.

a. Inclusion Criteria

- All antenatal mothers with gestational age 18-24weeks.
- Normotensive mother.
- Patient consenting for the study.

b. Exclusion Criteria

- Women not consenting for study.
- Women with known hypertension and diabetes.
- Women with previous history of pregnancy induced hypertension.
- Multiple gestation pregnancy.
- Autoimmune disease complicating pregnancy.
- Anti-phospholipid antibody syndrome.
- Renal disease complicating pregnancy

RESULTS

Table 1: Age Distribution

Age	N	%
<25 years	18	7.5
25-30	128	53.33
30-35	76	31.67
> 35 years	18	7.5
Total	240	100

Table 1 shows predominant number of patients in the study belonged to 25-30 years of age [about 53.3%].

Table 2: Distribution Based On Gravida Score

Gravida	N	%
G1	109	45.42
G2	79	32.92
G3	42	17.5
G4	9	3.75
G5	1	0.42
Total	240	100

Table 2 shows predominant number of patients in the study group were primigravida(G1). [about 45.42%]

Table 3: Number Of Patients With History Of Previous LSCS

Previous LSCS	N	%
No	187	77.92
Yes	53	22.08
Total	240	100

Table 3 shows about 22% of patients in the study population have had previous LSCS while 78% of patients had no previous LSCS.

Table 4: Distribution Based On Body Mass Index (BMI)-Asian Classification

BMI	N	%
<18.5-Underweight	4	1.67
18.5-22.9-Normal	47	19.58
23-24.9-Overweight	38	15.83
25-29.9-Obese I	100	41.67
>30-Obese II	51	21.25
Total	240	100

Table 4 shows 41.67 % patients belongs to class I obesity, 21.25% belongs to class II obesity, 15.83% belongs to overweight, 19.58% with normal Body Mass Index

Table 5: Distribution Based On Socio Economic Status(SES)-Modified Kuppaswamy scale

SES	N	%
UPPER	69	28.75
UPPER MIDDLE	147	61.25
LOWER MIDDLE	24	10.00
UPPER LOWER	0	-
LOWER	0	-
Total	240	100

Table 5 shows majority of patient belong to upper middle class 61.25%, lower middle had 10% patients.

Table 6: Distribution Based On Placenta Location

Placenta location	Number of patients	Percentage
Normal	215	89.58
Lateral	25	10.42
Total	240	100

Table 6 shows 89.58% patients had normal placenta location and 10.42% of patients in the study population had abnormal lateral placenta location

Table 7: Distribution Based On Uterine Artery Doppler Findings

Uterine artery doppler	Number of patients	Percentage
Normal	214	89.17
Abnormal	26	10.83
Total	240	100

Table 7 shows about 89.17% of patients in the study population had normal uterine artery doppler findings while 10.83% of patients had abnormal uterine artery doppler findings in the second trimester ultrasonography.

Table 8: Patients With Both Lateral Placental Location And Abnormal Uterine Artery Doppler Findings

Both lateral placental location and abnormal uterine artery doppler	Number of patients	Percentage
Yes	7	2.92
No	233	97.08
Total	240	100

Table 8 shows about 2.92% patients of the study population had both abnormal placental location and abnormal uterine artery doppler findings. [7 out of 240]

Table 9: Comparison Of History Of Previous LSCS And**Presence Of Lateral Placental Localization:**

Previous LSCS	Lateral placental location		Total	p – 0.207 [not significant]
	Yes	No		
Yes	8	45	53	
	32%	20.93%		
No	17	170	187	
	68%	79.07%		
Total	25	215	240	

Table 9 shows 8 patients out of 53 patients in the study population who have had previous LSCS had lateral placental localization. There was no statistical significance found in this comparison.

Table 10: Incidence Of Pregnancy Induced Hypertension In The Study Population

Pregnancy induced hypertension	Number of patients	Percentage
Yes	49	20.42
No	191	79.58
Total	240	100

Table 10 shows 49 patients out of 240 patients in the study population developed pregnancy induced hypertension.

Table 11: Comparison Of Incidence Of Pregnancy Induced Hypertension In Patients With Normal And Lateral Placental Location

	Pregnancy induced hypertension	No Pregnancy induced hypertension	Total	p < 0.001
Lateral placental location	13	12	25	
	52%	48%		
Normal placental location	36	179	215	
	16.74%	83.26%		
Total	49	191	240	

Table 11 shows 16.74% of patients with normal placental location developed pregnancy induced hypertension while 52% of patients with lateral placental location developed pregnancy induced hypertension with statistical significance. [p<0.001].

Table 12: Comparison Of Incidence Of Pregnancy Induced Hypertension In Patients With Normal And Abnormal Uterine Artery Doppler

	Pregnancy induced hypertension	No Pregnancy induced hypertension	Total	p < 0.001
Abnormal uterine artery doppler	19	7	26	
	73.07%	26.92%		
Normal uterine artery doppler	30	184	214	
	14.01%	85.98%		
Total	49	121	240	

Table 12 shows 14.01% of patients with normal uterine artery doppler developed pregnancy induced hypertension while 73.07% of patients with abnormal uterine artery doppler developed pregnancy induced hypertension with statistical significance. [p<0.001]

Table 13: Incidence Of Pregnancy Induced Hypertension In Patients With Both Lateral Placental Location And Abnormal Uterine Artery Doppler

	PIH	No PIH	Total	p < 0.001
Both lateral placental location and uterine artery doppler	7	0	7	
	100%	0		

Normal or either abnormal placental location or uterine artery doppler	42	191	233	
	18.03%	81.97%		
Total	49	191	240	

Table 13 shows 100% patients with both lateral placental location and abnormal uterine artery doppler developed pregnancy induced hypertension with statistical significance. [$p < 0.001$]

DISCUSSION

This study investigates the relationship between placental location, uterine artery Doppler findings, and the risk of pregnancy-induced hypertension (PIH) among 240 antenatal patients. The findings underscore a significant correlation between abnormal placental positioning, Doppler waveform results, and increased PIH risk.

Placental Location and Pregnancy-Induced Hypertension

In this cohort, 89.5% ($n=215$) of patients had a central (normal) placental location, with 16.74% of these individuals developing PIH. Conversely, in the group with lateral (abnormal) placental positioning (10.5%, $n=25$), the incidence of PIH was notably higher at 52%. This association between lateral placental location and PIH was statistically significant ($p < 0.0001$), yielding an odds ratio of 5.38 and a relative risk of 3.10, indicating that a lateral placental position substantially raises the likelihood of developing PIH.

Placental Location	PIH (n)	No PIH (n)	Total (n)	% PIH
Lateral (Abnormal)	13	12	25	52%
Central (Normal)	36	179	215	16.74%

Uterine Artery Doppler Findings and Pregnancy-Induced Hypertension

Further analysis revealed that abnormal uterine artery Doppler findings were associated with an even greater risk of PIH. Among the 214 patients with normal Doppler readings, 14.01% developed PIH. In contrast, among the 26 patients with abnormal Doppler findings, 73.07% experienced PIH, including one case of eclampsia. This was statistically significant ($p < 0.0001$), with an odds ratio of 16.64 and a relative risk of 5.20.

Uterine Artery Doppler	PIH (n)	No PIH (n)	Total (n)	% PIH
Abnormal	19	7	26	73.07%
Normal	30	184	214	14.01%

Combined Effect of Abnormal Placental Location and Uterine Artery Doppler Findings

When both lateral placental location and abnormal uterine artery Doppler findings were present, the incidence of PIH rose markedly to 100%, with all 7 patients in this category developing PIH, including one case of eclampsia. This association was highly significant ($p < 0.001$), with a relative risk of 5.54, emphasizing the compounded risk these two factors confer.

Combined Findings	PIH (n)	No PIH (n)	Total (n)	% PIH
Both Abnormal Placental and Doppler	7	0	7	100%
Normal or Either One Abnormal Finding	42	191	233	18.03%

Comparison with Other Studies

The incidence of PIH in this study (20.42%) was observed to be higher than the global average of 10-15% but aligns with findings from similar research. Comparable studies, such as those by Prathima et al., Shaweez et al., Shagufta et al., and Priyanka Ahuja et al., report PIH incidences ranging from 15% to 25.3%, supporting the broader relevance of this study's findings.

Study	Incidence of PIH (%)
Prathima et al (11)	15
Shaweez et al (14)	18.87
Shagufta et al (12)	25.3
Priyanka Ahuja et al (15)	16

Kore et al (16)	16
This Study	20.42

CONCLUSION

This study demonstrates that abnormal placental location and uterine artery Doppler readings in the second trimester significantly increase the risk of PIH, especially when both findings are present. The data suggests the potential benefit of routine Doppler and placental assessments during antenatal care to identify high-risk pregnancies early, thus improving maternal and fetal outcomes.

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