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ORIGINAL RESEARCH

Role of uterine artery doppler and platelet indices in predictors of hypertensive disorders of pregnancy

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Abstract

Background: One of the leading causes of maternal and perinatal death and morbidity worldwide, particularly in underdeveloped nations, is hypertensive disorders during pregnancy. The maternal mortality rate in affluent nations ranges from 4 to 40 deaths per 1 lakh live births. It ranges from 100 to 700 in poor nations, with India having 178 per 1 lakh live births.

Methods: The present prospective study was conducted among 100 individuals with hypertension problems during pregnancy who visit the OPD and IPD in the Obstetrics and Gynecology Department. All of the participants in this study had their pregnancies evaluated via ultrasound, and both the uterine and umbilical arteries' arterial dopplers was performed.

Results: With specificity and sensitivity of Uterine artery Doppler research - Pi Index as 91.67% and 85.71%, Ri Index as 87.5% and 71.43%, and diastolic notch as 94.44% and 92.85% correspondingly - using it in combination is considerably helpful in early prediction of PIH. The uterine artery Doppler study is a crucial technique for PIH early diagnosis and has significant prognostic significance.

Conclusions: The early-onset PIH is more accurately detected by uterine artery Doppler studies using Pi Index and Ri Index than the late-onset condition. As a result, it will eventually aid in stopping the rising rates of maternal and foetal morbidity and mortality.

Keywords: Hypertensive disorders, Pregnancy, Uterine artery doppler

Introduction

One of the main causes of maternal and perinatal death and morbidity worldwide, particularly in underdeveloped nations, is hypertensive disorders of pregnancy. Pregnancy-related hypertension is a symptom of an underlying illness that may already present or develop for the first time. The detection of this clinical issue and its successful care are crucial to preventing the negative effects on the course of the pregnancy. [1] A multi-system disorder called hypertensive disorders of pregnancy develops after 20 weeks of pregnancy in previously normotensive women. It is characterised by new onset hypertension (systolic and diastolic blood pressure of 140 and 90 mm Hg, respectively, on two occasions, at least 6 hours apart) and proteinuria (protein excretion of 300 mg in a 24 h urine collection, or a dipstick of 2+). [2]

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Preeclampsia can begin before 34 weeks of pregnancy or afterward. Hypertensive disorders of pregnancy can present with mild or severe symptoms (systolic blood pressure ≥ 160 mmHg or diastolic blood pressure ≥ 110 mmHg, proteinuria >5 g/24 hours, oliguria, neurological symptoms, and other clinical symptoms like abnormal liver function, thrombocytopenia 100 000 mm3, HELLP syndrome), and they can [3]

The clinical picture is complicated by the systemic involvement as well as a number of additional symptoms, including edoema, hemostasis disturbance, renal or hepatic failure, and the HELLP syndrome (hemolysis, high liver enzymes, and low platelet counts). According to the majority of theories regarding the aetiology of hypertensive disorders of pregnancy, the condition is caused by a cascade of events that include an abnormal maternal inflammatory response, endothelial cell activation/damage with an abnormal hemodynamic milieu, and an abnormal immune system. [4,5]

The many subtypes of hypertensive diseases during pregnancy have been attributed to a number of patho-physiological processes, either singly or in combination. These mechanisms, which are all influenced by genetic and environmental factors, include poor placental or endothelial response, increased immunological response to paternal antigens, systemic inflammatory response, and defective vascular remodelling of the maternal-fetal interface. The lack of diagnostic tools for identifying pregnant women at risk of developing pre-eclampsia has contributed to the heterogeneity of potential processes causing or resulting from hypertensive disorders of pregnancy, delaying recognition and serious complications, and hindering the evaluation of new preventive interventions. [6]

Nulliparity, multiple pregnancies, preeclampsia in the past, obesity, diabetes mellitus, vascular and connective tissue disorders like systemic lupus erythematosus and antiphospholipid antibodies, age >35 years at first pregnancy, smoking, and race of African Americans are risk factors for preeclampsia.

Ultrasonography The colour doppler examination may also aid in the diagnosis of hypertension. The persistence of high blood flow resistance in the uterine arteries of hypertensive women, which is one of the indirect signs of a defective placentation, aids in the early diagnosis of disease. [7] Depending on the severity of the disease, the modifications include an increased systolic to diastolic ratio, absence of diastolic flow, and reverse diastolic flow. [8] We may assess the resistance index, pulsatility index, systolic/diastolic ratio, diastolic/systolic ratio, and presence of any diastolic notch using uterine artery doppler velocity waveform analysis. [9]

The goal of the current study was to compare the sensitivity and specificity of biochemical indicators and uterine artery Doppler for the prediction and severity of hypertensive disorders during pregnancy as well as to learn more about the outcomes for the mother and the unborn child in these patients.

Methods

This research was conducted in Jammu at a medical school and hospital. There were about 100 pregnant patients who attended the OPD and IPD in the Obstetrics and Gynecology Department. A thorough clinical history as well as the patient's personal and major medical histories, obstetric history, and menstrual history was collected.

All patients will get a general examination, at which time the pulse, blood pressure, temperature, and respiratory rate was recorded. The heart, lungs, and other systems were thoroughly evaluated as part of the systemic assessment. All of the patients in this study group underwent all customary blood tests as well as additional procedures, such as biochemical markers. The pregnancy was thoroughly evaluated via ultrasound, and the uterine and umbilical arteries' arterial dopplers were both checked. All patients continued to receive routine follow-up care, and the results for the mother and foetus were recorded.

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Wherever necessary, the standard score Z = (T)/s was calculated using the statistical test, i.e. Z-test, where the distribution of the test statistic under the null hypothesis was approximated by a normal distribution, using expected value of T under the null hypothesis, and then obtaining an estimate S of the standard deviation of T.

Results

With specificity and sensitivity of Uterine Artery Doppler Study - Pi Index as 91.67% and 85.71%, Ri Index as 87.5% and 71.43%, and diastolic notch as 94.44% and 92.85% correspondingly - it is substantially helpful in the early prediction of PIH. Consequently, the uterine artery doppler scan should be a crucial part of the early diagnosis of PIH patients. It also plays a crucial role in the care of pregnant patients and the prevention of difficulties for both the mother and the foetus.

Table 1 displayed the age distribution of the 100 patients in my study group, revealing that 38% of them were between the ages of 20 and 24 and 27% were between the ages of 25 and 29. Only 8 of the patients were above 35 years old. Primigravida patients made up the majority of the 100 patients in the current study (81%), while multiparous women made up 19% of the patients. Of the 100 patients in the current study, 65 belonged to a lower socioeconomic category, whereas just 4 were high class and 34 were middle class. 125 normotensive participants were included in the trial at various gestational stages. 65 patients were in the gestational period of 25-29 weeks and came for proper follow-up and additional investigations. Of the 24 patients registered between 16 and 20 weeks, 9 patients were registered and 15 patients were dropped off. Of the 36 patients registered between 20 and 24 weeks, 26 patients were registered and 10 patients were dropped off.

100 participants in this trial group with normal blood pressure at various gestational stages. 65 patients in the gestational period of 25–29 weeks were among the 9% patients registered between 16 and 20 weeks who were advised and accepted for follow-up and additional investigations during their gestational period. Out of 100 patients who had been followed up (16-20 weeks - 9 patients, 21-24 weeks - 26 patients, and 25-29 weeks - 65 patients), 72 had normal blood pressure, 66 had a normal Pi Index, and 6 had a slightly raised level. 24 of the 28 PIH patients exhibited increased Pi indices, while 4 had normal indices. According to this outcome, the Pi Index's specificity and sensitivity were 91.67% and 85.71%, respectively, with a PPV of 80%, NPV of 94.29%, and accuracy of 90%. Table 9 of this article shows the Ri Index for 100 patients at various gestational weeks (16-20 weeks-9 patients, 21-24 weeks - 26 patients, 25-29 weeks-65 patients). Out of 100 normotensive patients who underwent follow-up, 72 remained normotensive; of these, 63 had normal Ri Index levels and 9 had slightly higher levels. On follow-up, 28 patients had acquired PIH, and 20 of them had increased levels of Ri Index while 8 had normal levels.

Table 1: Distribution of subjects

Variables	N	%
Age in years		
20-24	48	48
25-29	27	27
29-33	17	17
34-38	7	7
39-40	1	1
Parity		
Para 1	22	22
Para 2	32	32
Para 3	20	20

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Para 4 Para 5	18 8	18 8
SES Status Lower Class 65 65 Middle Class 31 31 Upper Class 4 4	 65 31 4	 65 31 4
Gestational Period 16-20 weeks 20-24 weeks 25-29 weeks	 9 26 65	 9 26 65

Table 2: Doppler study of uterine artery (Pi Index and Ri Index for predicting PIH at different gestational period)

Gestational period	Total no. of patients	Normal (TN)	Elevated (FP)	Normal (FN)	Mild Elevated (TP)	Severe Elevated (TP)
Pi Index						
16-20 weeks	9	6	1	1	1	0
20-24 weeks	26	19	2	1	3	1
25-29 weeks	65	41	3	2	15	4
Ri Index						
16-20 weeks	9	5	2	1	1	0
20-24 weeks	26	14	4	4	2	2
25-29 weeks	65	44	3	3	6	9

Discussion

The most prevalent obstetrical condition worldwide, including on a national level in India, is pregnancy-induced hypertension. It is a significant contributor to maternal and foetal death. In this study, 55% of participants were aged 20 to 35, 7% were aged 34 to 38, and 1% were aged 39 to 40. Sajith M et al evaluated the same age categories in their study, which included 1330 patients, 104 of them were between the ages of 18 and 32. [10]

The majority of the patients in my study, which was based on parity, belonged to the Primigravidae group, which made up around 81% of all patients. In their study on the prevalence of preeclampsia in pregnant women, Kooffreh ME et al. included 8524 pregnant women, and their findings revealed that 104 patients, or the majority of patients, fell into the Primigravida category. [11]

65% of the patients in the current study, the majority, came from lower socioeconomic position. The majority of patients (61%), according to Aabidha PM et alstudy .'s on maternal and foetal outcomes in preeclampsia in a secondary care hospital in South India, were from lower socioeconomic background. [12]

The Doppler Study of Uterine Artery with 100 patients was displayed. In this table, out of 100 patients, the Pi Index was normal in 66 patients and elevated in 6 patients, while the Ri Index was normal in 63 patients and elevated in 6 patients, and the diastolic notch was absent in 68 patients and present in 4 patients, out of the 72 patients who were normotensive on follow-up. In contrast, among 28 patients with PIH, 24 patients' Pi Indexes were increased, 4 patients' Pi Indexes were normal, 20 patients' Ri Indexes were elevated, 8 patients' Ri Indexes were normal, and 26 patients' diastolic notches were present. This table demonstrated the specificity and sensitivity of the Pi Index, Ri Index, and diastolic Notch as 91.67%, 87.5%, and 94.44% and 85.71%, 71.43%, and 92.86% respectively, along with Pi Index PPV 80%, NPV 94.29%, and accuracy of 90%, whereas Ri Index PPV 68.97%, NPV 88.73%, and accuracy of 83%, and diastolic notch.

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Conclusion

The early-onset PIH is more accurately detected by uterine artery Doppler studies using Pi Index and Ri Index than the late-onset condition. As a result, it will eventually aid in stopping the rising rates of maternal and foetal morbidity and mortality.

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