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Original Article

First Trimester Prediction of Hypertensive Disorders in Pregnancy Using Doppler Ultrasonography in an African Population

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A R T I C L E   I N F O

A B S T R A C T

Objective: To determine the predictive value of abnormal Doppler indices in the first trimester for development of hypertensive disorders in pregnancy in an African population. **Methods:**This was a longitudinal study in Ile-Ife, Nigeria, seventy-five primigravidae were enrolled between January 2012 to May 2013. They had Doppler ultrasound between 11 – 13 weeks of gestation. The PI, RI and presence of early diastolic notch were noted and they were followed up until a week after delivery for development of hypertension. Results were analysed using SPSS 17. **Results:** Ten(13.3%) of the participants developed hypertensive disorder in pregnancy. Seven(70%) developed preeclampsia; two(20%) had PIH and one(10%) had preeclampsia superimposed on chronic hypertension. Seven (35%) of those with an early diastolic notch developed hypertension (p=0.003); five(12.2%) of those with abnormal PI(p=0.751) and 4(10.5%) of those with abnormal RI (p=0.516). The relative risk (RR) of developing hypertensive disorder with presence of early diastolic notch was 6.4; RR of developing hypertensive disorder with abnormal PI was 0.83 and RR of developing hypertensive disorder with abnormal RI was 0.65. **Conclusions:** Presence of early diastolic notch in the first trimester is highly predictive of development of hypertensive disorders later in pregnancy.

Key words: Doppler ultrasound; hypertensive disorder; pregnancy; prediction, primigravida.

1. INTRODUCTION

Even Hypertensive disorders in pregnancy is seen in 0.34-11.5% of pregnancies globally.[1] It complicates 11% of first pregnancies; two third of which are associated with pre-eclampsia.[2] Early detection of the subset of women likely to develop hypertensive

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was recorded. Om et al[8] used reference range of PI 1.0-1.90; RI 0.74-0.91 and absence of notch. The patients were then followed up during the traditional antenatal care until a week after delivery for early detection of symptoms and signs of hypertension in pregnancy.

Study data was processed using SPSS version 17 (IBM, Armonk, NY, USA). Frequency tables and charts were made and results were tested for significance using the student t-test for continuous variables and chi square or Fisher exact test for categorical variables with level of significance (x) set at $< 0. 05$.

Table 1: Socio-demographic characteristics of the respondents

Characteristics	Had hypertensive disorders N=10	No hypertensive disorder N=65	Total N=75	P value
Age				
<19	1(10.0)	2(3.1)	3(4.0)	
19-35	9(90.0)	62(95.4)	71(94.7)	
>35	0	1(1.5)	1(1.3)	0.78
BMI				
Normal	6(60.0)	51(78.5)	57(76.0)	
Over weight	3(30.0)	9(13.8)	12(16.0)	
Obese	1(10.0)	5(7.7)	6(8.0)	0.84
Family history of preeclampsia				
None	4(40.0)	55(84.6)	59(78.7)	
Sister only	4(40.0)	5(7.7)	9(12.0)	
Mother only	0	3(4.6)	3(4.0)	
Both	2(20)	2(3.1)	4(5.3)	
				0.39
History of chronic hypertension	1(10)	2(3.1)	3(4.0)	
Yes	9(90)	63(96.9)	72(96.0)	
No				0.62

Table 2: Type of hypertension in pregnancy developed

Type of hypertension	N=10(%)	Mean PI	Mean RI
Preeclampsia	7(70)	1.75±0.45	1.41±0.64
PIH	2(20)	1.69±0.58	1.05±0.49
Chronic hypertension with superimposed preeclampsia	1(10)	2.1	1.4

3. RESULTS

Ninety women who met the inclusion criteria were enrolled into the study. Five of them had miscarriages while ten were lost to follow up. This leaves seventy-five patients who completed the study.

Table I shows the sociodemographic characteristics of the participants. Seventy-one (94.7%) of the participants were between ages 19-35 years with a mean age of 25.8years. Fifty-seven (76.0%) of them had normal body mass index (BMI) while 6 (8.0%) were obese. Fifty-nine (78.7%) of the participants had no family history of preeclampsia while four (5.3%) had both mother and sisters who had preeclampsia. There were three (4.0%) participants with history of chronic hypertension.

Table II shows the type of hypertensive disorder seen in the participants. Ten (13.3%) of the participants developed hypertensive disorder in pregnancy of which seven (70%)had preeclampsia.

Table III shows the summary of the Doppler indices and the proportion that developed hypertension in pregnancy among those with normal and abnormal indices with their p value. The presence of an early diastolic notch was statistically significant with p=0.003 while PI (p=0.751) and RI (p=0.516) were not statistically significant.

Table 3: Summary of Doppler indices

Doppler indices	Character	Developed hypertension	No hypertension	Total	P value
Pulsatility index	Normal	5(14.7)	29(85.3)	34(45.3)	0.751
	Abnormal	5(12.2)	36(87.8)	41(54.7)	
Resistance index	Normal	6(16.2)	31(83.8)	37(49.3)	0.516
	Abnormal	4(10.5)	34(89.5)	38(50.7)	
Presence of notch	Yes	7(35)	13(65)	20(26.7)	0.003*
	No	3(5.5)	52(94.5)	55(73.3)	

*significant at p value < 0.05.

The relative risk (RR) of developing hypertensive disorder with presence of early diastolic notch was 6.4; RR of developing hypertensive disorder with abnormal PI was 0.83 and RR of developing hypertensive disorder with abnormal RI was0.65.

The positive predictive value of PI for development of hypertension in pregnancy was 12%; the positive predictive value of RI for development of hypertension in pregnancy was 11% while the positive predictive

value of presence of early diastolic notch for development of hypertension in pregnancy was 35%.

4. DISCUSSION

The sociodemographic characteristic of both groups i.e. the group that developed hypertension and that which did not were similar. With respect to age, the largest proportion was in age group "19-35". Majority of the participants in both groups were of the Yoruba tribe. Most of those that developed hypertension had a normal body mass index unlike what was found by Poon and co-workers.[9] Most of those that developed hypertension had a family history of preeclampsia; this agrees with the belief that family history of preeclampsia is one of the two most important predictive factors for hypertensive disorder in pregnancy alongside nulliparity.[10]

The incidence of hypertensive disorder in pregnancy in the study population was 13.3% which is more than 11.6% found by Ebeigbe and co-workers in Benin;[6] although the incidence depends on age distribution, ethnic differences, socioeconomic status, and number of previous deliveries. In this population of primigravidae which on its own is a significant predictive factor,[10] the incidence is expected to be higher than that of the general populace. However, the high proportion of preeclampsia among the hypertensive disorders developed is in consonance with what was found by other researchers.[9, 10]

Earlier workers,[8] had found that there was no difference between the left and right uterine artery indices, nevertheless both were studied and the mean was calculated. The mean PI gotten in the total population was similar to that found by Plascenciaet al.[4] The sensitivity of PI for predicting hypertensive disorders in the first trimester was found to be 50% with a positive predictive value of 12%. The presence of an abnormal PI was not statistically significant for development of hypertensive disorder in pregnancy (p=0.751). The sensitivity of PI found in this study was higher than that found by Hung et al where they found sensitivity less than 50%.[11]

The mean RI gotten for the population that developed hypertension was 1.34 ± 0.57. The sensitivity and positive predictive value were similar to that gotten by Liao and co-workers.[12] It was however found not to be statistically significant when tested for development of hypertension.

In this study, early diastolic notch was found in 26.7% of the study population. This was larger than 18.4% found by Plasencia.[4] Its presence in either artery was found to have the best predictive value of all the three. It had a higher sensitivity (70%) than abnormal PI and RI as well as a higher positive predictive value (35%). It was also found to be statistically significant in predicting development of hypertensive disorder in pregnancy (p=0.003). This however does not agree with the work of some researchers who believe that prevalence of early diastolic notch in the first trimester is a normal finding since it was found in greater than half the population they studied.[12, 13]

When presence of multiple Doppler indices abnormality was tested for significance in predicting development of hypertensive disorder in pregnancy; it was found not to have a better predictive value than when a single abnormal Doppler index was used. The predictive value of various combinations was rather lower.

There was a statistically significant difference in the mean gestational age at delivery between both groups, with the group that developed hypertension having a lower mean gestational age at delivery. This was similar to that found by Herraiz and co-workers.[14] The mode of delivery was not statistically affected by development of hypertension.

In conclusion, the outcome from this study showed that the presence of an early diastolic notch was predictive of development of hypertensive disorder of pregnancy later in pregnancy. However, neither the presence of an abnormal PI nor the presence of abnormal RI was predictive of development of hypertensive disorder of pregnancy later in pregnancy.

The result of this study would help serve as a reference range for Doppler studies of the uterine artery in the first trimester of pregnancy. It would also help to determine reference values that would be chosen by various hospitals to predict hypertensive disorders of pregnancy.

5. ACKNOWLEDGEMENT

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