

# Uterine artery Doppler as a predictor of pre eclampsia - hospital based study

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## Abstract

**Aim:** Study of early second trimester (13-16wks) uterine artery Doppler as predictor of pre eclampsia. **Objective:** To study whether early changes in uterine artery Doppler have better predictive value for preeclampsia as compared to gestational hypertension. To analyze the maternal and fetal outcome in cases with pre eclampsia vs gestational hypertension. **Material & Methods:** From 2009 to 2011, we conducted an institutional based study among 100 pregnant women. Uterine artery Doppler was done in the women in early second trimester during the antenatal visits at Niloufer Hospital. We measured and recorded the BP, urine analysis, complete blood work done in every antenatal visit. These women were followed up to their delivery. Data were analyzed and  $p < 0.05$  was considered significant. **Results:** Pre eclampsia developed in 31.25% of the pregnant women with bilateral uterine artery notching at 13-16 weeks of gestational age Odds ratio of patients developing hypertension with uterine artery notching is 6.6. Chi-square = 11.8, P value  $< 0.0005$  (significant). This study has a sensitivity of 71.42%, specificity of 74.41%, positive predictive value of 31.25% and negative predictive value of 94.11% in predicting onset of preeclampsia in pregnancy. **Conclusion:** Uterine artery Doppler should be done routinely in all pregnant women as risk factors can be identified at an early stage where timely intervention can reduce the maternal and neonatal complications.

**Keywords:** Uterine artery Doppler, Pre eclampsia, Gestational hypertension, Early second trimester

## Introduction

Hypertensive disorders are the most common medical complications of pregnancy (7.15%) and a major cause of maternal morbidity and mortality (30%) and fetal mortality and morbidity (22%) [1].

Clinically, classification of hypertension in pregnancy differentiates between gestational hypertension and preeclampsia based upon the presence of proteinuria [2]. The outcome of pregnancy in terms of maternal morbidity and mortality, fetal morbidity and mortality has shown to be far better with gestational hypertension as compared to preeclampsia this is because it has been postulated that etiopathogenesis of two conditions are distinct [3]. In preeclampsia incomplete trophoblast

invasion in the early second trimester with insufficient changes of the uterine and uteroplacental circulation into a low impedance system has been proposed as a pathophysiological mechanism for the development of preeclampsia.

This abnormal placentation is reflected in the reduced diastolic flow in uterine arteries as evidenced by diastolic notching in the uterine artery wave form [3].

With the use of Doppler technology, a non invasive technique for evaluating the uterine and uteroplacental circulation, it has been possible to show a strong positive correlation between uterine vascular resistance expressed by persistence of an early diastolic notch in the Doppler waveform and onset of preeclampsia. Doppler waveform – uterine artery notching – has been

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reported to be associated with subsequent increased risks for preeclampsia or growth restricted infants [4,5].

The purpose of this study is to evaluate the predictive value of uterine artery doppler with regard to the development of preeclampsia and to compare the maternal and fetal outcomes in gestational hypertension and pre eclamsia.

## Materials and Methods

**Study Group:** Hundred pregnant women (primis and mults), attending antenatal outpatient department without previous record of hypertension or renal disease were studied.

Women with twin pregnancy, obesity, placenta previa, previous history of bleeding disorders, thrombotic disorders and fetal anomalies, were excluded from the study.

**Period of Study:** The study was conducted at Niloufer Hospital for women and children, Osmania Medical College, Hyderabad from October 2014-September 2015.

**Method:** Hundred pregnant women attending antenatal outpatient department underwent bilateral uterine artery Doppler investigation at 13 – 16 weeks of gestation.

Uterine artery Doppler was performed during second trimester by means of a color Doppler power vision 6000 (THOSHIBA Corp, TOKYO, JAPAN) using a 3.5 -5 MHz transabdominal transducer.

Patients were examined in a semirecumbent position.

The recording was performed at the apparent crossover point of the uterine and internal iliac arteries, after identification of the main uterine artery on a longitudinal scan lateral to the uterus.

The presence of an early diastolic notch on both sides of the uterine artery waveforms was recorded.

## Results

**Figure-1: Flow chart – distribution of 100 pregnant women attending antenatal OP who were investigated by uterine artery Doppler at 13-16wks.**

In our study age wise distribution of pregnant women who developed pre-eclampsia in less than 20 years was 2 and between 20-25 years were 14 where as only 2 women in 20-25 age had developed Gestational hypertension.

At every antenatal visit, urine was tested for protein and blood pressure recordings were taken. Further analysis was done dividing patients as normotensive and those patients developing hypertension after 20 weeks of gestation.

Hypertension was defined as blood pressure of at least 140/90 mm of Hg, two measurements four hours apart.

Hypertension was classified either as preeclampsia or gestational hypertension following the criteria defined by the report of the National Blood Pressure Education Programme (2000) [2].

Maternal monitoring included blood pressure measurements, Hemoglobin platelets, uric acid, liver enzymes; renal function tests were checked twice a week. None of the patients were on antihypertensive drugs at the time of first Doppler evaluation.

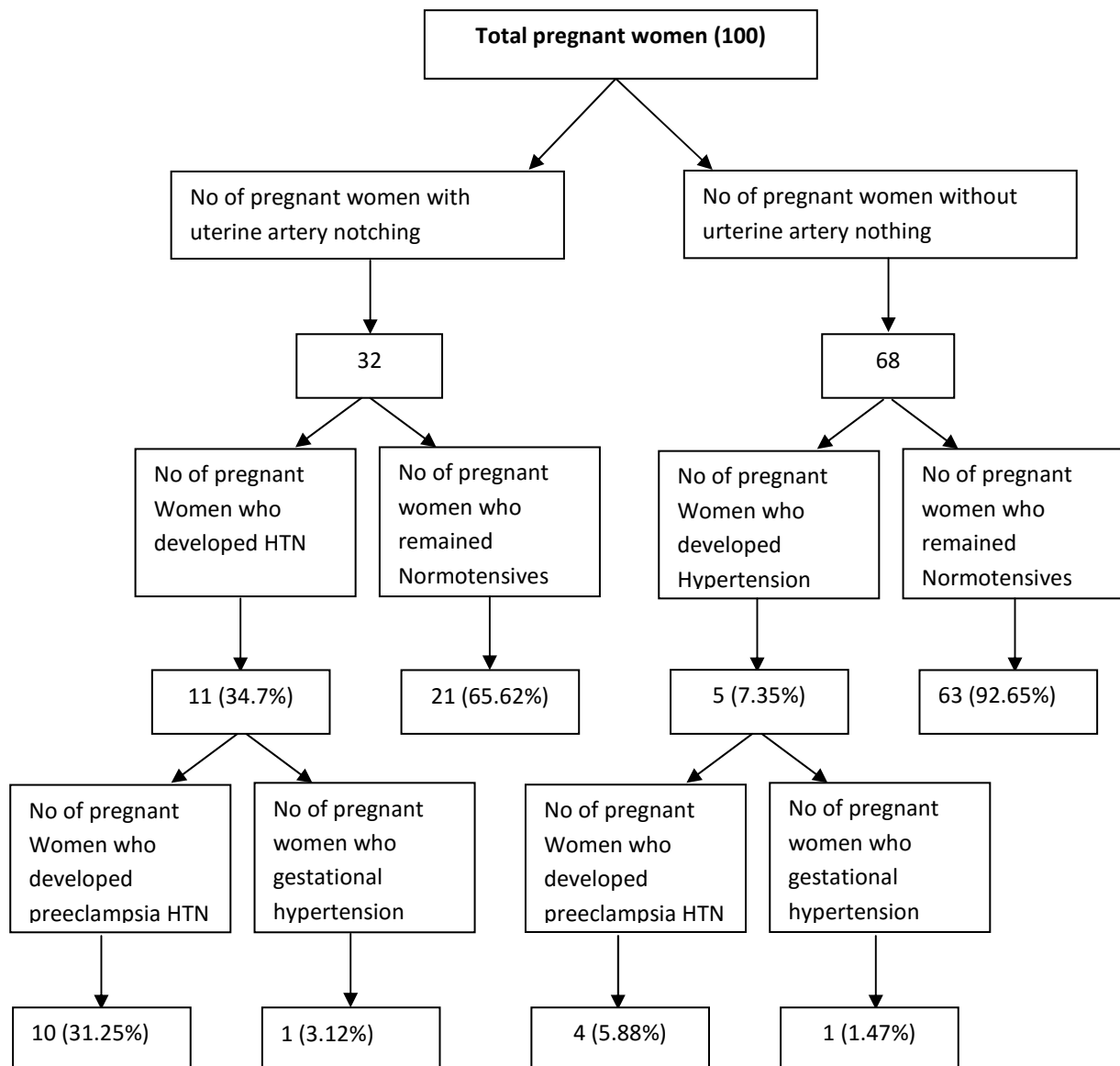
In women with hypertension Antenatal fetal surveillance included NST, MBPP twice weekly starting at 32 weeks.

Antihypertensive drugs used were oral nifedipine 30-120 mg /day, alpha methyl dopa 250 mg or 500 mg tid, oral or iv Labetalol. Magnesium sulfate was used when patient developed imminent signs and symptoms of eclampsia.

Biochemical tests for CBP with platelets, LFT and RFT are done at weekly intervals in patients managed conservatively till 34 – 36wks of gestation. They were followed till delivery and maternal and fetal outcome were analyzed.

Patients were reviewed at 2wks, 6wks and 12wks following delivery for persistence of hypertension. Chi-square test was used for comparison of frequencies.

A p value below or equal to 0.05 was considered to be statistically significant for a 95% CI. The data were analyzed through SPSS 10.0 (SPSS Inc.)



**Figure-1:** depicts the study procedure and stages with outcome of the study

**Table-1:** Distribution of pregnant women with uterine artery notching according to age (n=32).

Age	No. of pregnant women with uterine artery notching
<20 yrs	3 (9.37%)
20 – 25 yrs	29 (90.62%)

There is no significance (Yates corrected  $\chi^2=0.36$  ( $P>0.05$ )) among age of pregnant women with uterine artery notching (Table 1).

Women developed pre-eclampsia are primigravida with significance (Yates corrected  $\chi^2 = 10.90$ ,  $P < 0.004$  significant). Only 2 multigravida women developed pre-eclampsia and 4 gestational hypertension.

Thirty primigravida women were found to have uterine artery notching and only 2 multigravida had notching .

**Table-2: No. of women who developed pre-eclampsia and gestational hypertension with and without uterine artery notching (n=16).**

	With uterine artery notching (n=11)	Without uterine artery notching (n=5)
Pre-eclampsia	10 (31.25%)	4 (5.88%)
Gestational Hypertension	1 (3.12%)	1 (1.47%)

Odds ratio for women who developed pre-eclampsia and gestational hypertension with and without uterine artery notching is 2.5. Yates corrected  $\chi^2 = 0.04$  (  $P < 0.05$ ) significant (Table 2).

**Table-3: Maternal and Neonatal complications in women with uterine artery notching.**

Maternal	With hypertension	Without hypertension
Abruption	3	-
Eclampsia	1	-
Neonatal	With hypertension	Without hypertension
MAS	-	-
IUGR	8	-
RDS	-	3
IUD	3	-

The neonatal outcome significantly was affected by presence of uterine artery notching than in the absence of hypertension.

There is higher rate of NICU admission of babies with uterine artery notching and hypertension. Eight babies with hypertensive mothers were admitted in the NICU compare to 3 babies with non hypertensive mothers. Yates corrected  $\chi^2 = 13.67$  ( $P < 0.0002$ ) significant (Table 3).

**Table-4: Gestational age at which hypertension developed among pregnant women with uterine artery notching.**

Gestational age in weeks	No. of women developed Hypertension.
20 – 28 weeks	8 (72.72%)
29 – 36 weeks	3 (27.27%)

When uterine artery diastolic notching is present women developed hypertension at an earlier gestational age (Table 4).

**Table-5: Gestational age at which the pregnant women delivered with uterine artery notching (n = 32).**

Gestational age in weeks	No. of pregnant women with hypertension	No. of pregnant women without hypertension
< 34 weeks	10 (90.9%)	2 (9.52%)
> 34 weeks	1 (9.09%)	19 (90.47%)

Odds ratio for women with uterine artery notching and without uterine artery notching is 8.16. As Hypertension develops at earlier gestational age in women with uterine artery notching incidence of preterm delivery is high. Yates corrected  $\chi^2 = 17.08$   $P < 0.000059$  significant (Table 5).

Five pregnant women more than 34 weeks gestation delivered with hypertension and without uterine artery notching. Women who developed hypertension without uterine artery notching has low incidence of preterm deliveries.

Odds ratio of patients developing hypertension with uterine artery notching is 6.6. Chi-square = 11.8, P value < 0.0005 (significant). Bilateral uterine artery notching at 13-16wks of gestational age has 71.42% sensitivity, 74.41% specificity, 31.25% positive predictive value and 94.11% negative predictive value for pre-eclampsia (Table 6).

**Table-6: Bilateral uterine artery notching at 13-16weeks.**

<b>Sensitivity</b> 71.42%	<b>Specificity</b> 74.41%
<b>Positive Predictive Value</b> 31.25%	<b>Negative Predictive Value</b> 94.11%

## Discussion

Hypertensive disorders complicating pregnancy cause maternal mortality, morbidity and fetal mortality, morbidity. Preeclampsia is a complex clinical syndrome involving multiple organ system. The search for an ideal predictive test and preventive measures remains challenging.

In 7 of the 13 studies analyzed [6, 7, 8, 9, 10, 11, 12] uterine artery was found to be suitable screening tool. Three studies [13, 14, 15] were inconclusive. While three studies [16,17,18] showed that uterine artery Doppler is of no value in predicting onset of preeclampsia.

In our study of 100 pregnant women, pre eclampsia developed in 31.25% of the pregnant women with bilateral uterine artery notching at 13-16 weeks of gestational age, sensitivity of the test is 71.42%, specificity is 74.41%, Positive predictive value is 31.25%, negative predictive value is 94.11%.

Our study results are comparable to study of Gupta Shashi et al [19] in 2009 study of 88 women with bilateral uterine notch at 12-16 weeks of gestation. Results shown that preclampsia developed in 31.42%, sensitivity is 68.75%, specificity 66.6%, positive predictive value 31.42%, negative predictive value 90.5%. Harrington K et al, in 1997 [20] described preclampsia in 15.16% of the women with bilateral uterine artery notch at 12 – 16 weeks of gestation. His study showed increased risk of preclampsia, premature delivery and the delivery of a small for gestational age baby.

In our study, out of 100 women 14 developed preclampsia and 2 developed gestational hypertension with or without uterine artery notching. Poon L.C.Y. et

al (2009) [21], examined 9149 singleton pregnancies and there were 8061 (96.4%) cases unaffected by PE or GH, 165 (2.0%) that developed PE including 37 that required delivery before 34 weeks (early PE) and 128 with late PE and 140 (1.7%) that developed GH.

In our study of 100 pregnant women, 3 women who had gestational hypertension 1 women progressed to preeclampsia. Patrick Saudan et al [22] retrospective analysis, 416 women initially presented as having gestational hypertension progressed to preclampsia 62 (15%). In the prospective study, 112 women initially presented with gestational hypertension and 29 progressed to preclampsia.

In women who developed hypertension (n=16) 9 babies developed intrauterine growth restriction, 2 babies developed meconium aspiration syndrome and respiratory distress syndrome, there were 3 intrauterine deaths. Agarwal et al [23] (2009) conducted a study on 53 women, 38 primiparas forming group I and 15 high risk pregnancies forming group II. Eight of the 38 in group I and nine of the 15 in group II showed persistence of bilateral notching. Of these seventeen, nine developed IUGR with PIH and 8 developed IUGR alone. A higher percentage of preclampsic women developed IUGR and neonatal complications, (11/14) 78.57% as compared to women with gestational hypertension (1/2)50%.

## Conclusions

1. Women who developed hypertension with uterine artery notching had more maternal and neonatal complications compared to women who developed hypertension without uterine artery notching reflecting the early onset of placental pathology. Women with pre eclampsia had more maternal and neonatal complications compared to women with gestational hypertension.

2. Based on our results, primigravida were found more prone to hypertension. Hence, we recommend early uterine artery Doppler to predict pre eclampsia and follow up and can decrease maternal and neonatal complications.

3. Routine BP monitoring should be done at primary health center and should be referred to tertiary center early if any intervention is required.

4. Administration of low dose aspirin increased calcium intake, antioxidant and nitric oxide usage can be instituted to prevent or arrest the progress of the disease and improve maternal and neonatal outcome.

5. We conclude, early second trimester uterine artery Doppler should be included as a routine investigation in high risk pregnancies.

6. In the future the results of this study can be extrapolated to show the efficacy of preventive measures taken early in pregnancy in women who have bilateral uterine notch.

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