

## UTERINE ARTERY DOPPLER – AN INDICATOR TO PREDICT COMPLICATIONS IN PREGNANCY

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### ABSTRACT

Hypertension and fetal growth retardation are major complication seen in pregnancy worldwide. It varies around 5 to 10 percent worldwide and is more at developing countries like India. Second trimester uterine artery Doppler is known to predict and hypertension disorder in pregnant females.

Objective of my study is to evaluate the use of first trimester uterine Doppler to pre-empt the development of hypertension and fetal growth retardation later in the pregnancy. This is a prospective study in which 200 patients attending outdoor facility of the hospital were examined.

The findings concluded that first trimester uterine artery screening is promising tool to screen the pregnant females to pre-empt the disease before it manifests clinically later.

**KEYWORDS** : First trimester uterine artery Doppler, Pulsatility Index, Fetal growth retardation

### INTRODUCTION –

Hypertension affects 5-10 percent of pregnancies worldwide and is one of the major causes of maternal morbidity, mortality and fetal growth retardation [1-3]. The cause of it is due to abnormal placenta formation. Placental development occurs in two stages – In first trimester the trophoblastic cells invade the intradecidual portion of the spiral arteries. This is followed by the second stage where deeper trophoblastic invasion occurs into the myometrial segments of the spiral arteries. The second stage happens from 14 weeks gestation. The loss of smooth muscle and elastica from the spiral arteries converts the uteroplacental circulation into a low resistance, high capacitance system [4,5]. Placental remodeling is completed by 16-18 weeks gestation. Defective placental development leads to hypoperfusion, hypoxic reperfusion injury and oxidative stress. This is thought to be the underlying cause of gestational hypertension, preeclampsia, and fetal growth restriction. Uterine artery evaluation was carried out to detect the abnormal first stage of placental development and thus predict complication earlier in the pregnancy.

### MATERIALS AND METHODS –

A prospective quantitative experimental study was conducted to test the hypothesis that first trimester uterine artery Doppler screening is able to identify patients at risk of developing [pre-eclampsia](#) or fetal growth retardation.

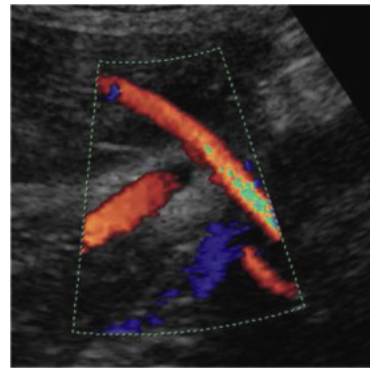
All the patients between 12 to 14 weeks gestation attending the outdoor patient department facility of BKL Walawalkar Rural Medical College from July 2017 to July 2018 were included in the study. Patients with the following conditions were excluded from the study:

1. Multiple gestations.
2. Ones with abnormal Nuchal translucency or absent nasal bone {considering the possibility that these patients might opt for medical termination of [pregnancy](#)}.
3. Patients on treatment for hypertensive disorders.

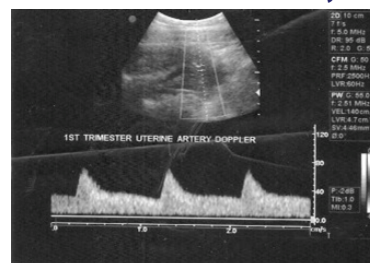
After explaining the objectives of the study, written informed consent was obtained from the women who agreed to participate in the study. All the patients were examined clinically and ultrasound study was conducted at regular intervals to look for changes of hypertension or fetal growth retardation.

GE Color Doppler machine was used to record all the readings. The transabdominal approach was preferred as it is less invasive. The probe was placed lateral to the uterus and the [transducer](#) gently tilted medially until the UA was identified where it crossed over the external iliac artery ( [Fig.1](#)). The sample gate was placed over the entire diameter of the artery and pulsed wave Doppler was used to obtain three consecutive UA waveforms. Doppler sampling gate

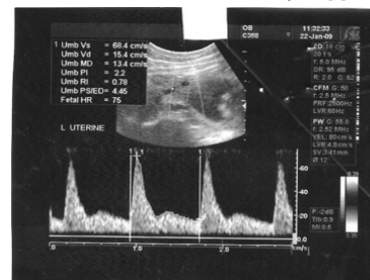
was set at 2 mm. The smallest angle of insonation ( $<30^\circ$ ) was obtained in order to achieve the highest systolic and end-diastolic velocities. The pulsatility index was measured bilaterally. Presence of notching was noted too.



**Fig. 1 demonstrates a normal UA at iliac artery crossing**



**Fig. 2. Normal 1st trimester uterine artery Doppler waveform**



**Fig. 3. Abnormal uterine artery Doppler waveform with notching and a high PI**

Descriptive and inferential statistical analyses were performed with [SPSS](#) version 18.0.

### RESULTS

A total of 200 participants were included in the study group. In our

study PI values ranged between 0.96 to 1.76. In my study 18 participants had PI value 1.5 or above. 90 participants had early diastolic notching. All the 18 individuals having high PI values had early diastolic notch. 23 participants out of 200 developed hypertensive disorder – 5 had early onset and 18 had late onset disease. Out of the 18 individuals having high PI value and notching 15 developed hypertension (5 had early onset and 10 had late onset preeclampsia). 5 infants had fetal retardation. All of these were from the group of 18 who had raised PI and diastolic notching.

## DISCUSSION –

Hypertension in pregnancy complicates around five to ten percent of pregnancies worldwide. In our study 10.15 percent pregnancies had hypertension. Out of these nine percent had late onset type and 2.5 percent had early onset one. 2.5 percent fetus did had growth retardation.

The mean PI value in my study was 1.36. The maximum PI value found in my study was 1.76. It was not above 95<sup>th</sup> centile as described by Gomez et.al [6]. However eighteen participants had value of 1.5 or more.

“Notching” appears to be a common feature of the uterine artery Doppler waveform in pregnancy, as it is present in 46–64% of normal gestations in the first trimester. In my study we found notching in 45 percent of participants. None of the participants who didn't had notching developed pre-eclapsia. Overall, notching demonstrates a low positive predictive value for preeclampsia and fetal growth retardation, in contrast to its 100% negative predictive value for these conditions in a high risk study population. The poor reproducibility of uterine artery notching has led to its omission from recent research in this field, with a trend instead toward inclusion of more objective measures of vascular impedance, favoring PI. As the formula for the calculation of the PI includes the area below the waveform [(peak systolic – end-diastolic velocity)/mean velocity], the PI indirectly includes the presence or absence of an early diastolic notch. Thus if the patient has diastolic notch along with raised PI value then possibility of she developing complications later increase. Notch alone does not have much of significance.

## CONCLUSIONS

The predictive accuracy of first-trimester uterine artery Doppler is better in the detection of early-onset preeclampsia and FGR than late-onset preeclampsia disease. The sensitivities and specificities of uterine artery Doppler indices {PI value and Notching} for the prediction of preeclampsia in low risk populations vary from 34% to 76% and 83% to 93%, respectively. The low sensitivity of this test limits its utility as a disease marker in isolation. Pre-empting the complication early in the pregnancy can be improved with multiparametric models. Algorithms that combine maternal characteristics, uterine artery Doppler velocimetry, and biochemical markers in the first trimester have the potential to improve the detection rate of early-onset preeclampsia to over 90% at a false positive rate of 10%. Further research is required to evaluate the various combination of multiparametric models, in addition to assessing the impact of screening on clinical outcomes.

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