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Research Article

## Role of uterine artery Doppler and roll over test in prediction of pregnancy induced hypertension

Leelavathi, Kaytri S.\*

Department of Obstetrics and Gynaecology, JSS medical college and Hospital, Mysore, Karnataka, India

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**\*Correspondence:**

Dr. Kaytri S.,

E-mail: [dr.kaytri@gmail.com](mailto:dr.kaytri@gmail.com)

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### ABSTRACT

**Background:** The objectives of the study were the role of uterine artery Doppler ultrasound and roll over test in prediction of PIH.

**Methods:** After assessment of inclusion and exclusion criteria 54 antenatal women of 11-13 weeks of gestation selected for study in Department of Obstetrics and Gynecology of JSS Hospital, Mysore and are subjected to transabdominal ultrasound for dating scan and screening of uterine artery Doppler ultrasound at 11-13 weeks and again rescanned at 21-24 weeks for uterine artery Doppler ultrasound and further followed up for Roll Over Test at 28-32 weeks of gestation for development of gestational hypertension, preeclampsia and eclampsia. The presence of early diastolic notch, increased pulsatility index and resistance index are considered to be a positive predictor of preeclampsia. A positive Roll Over test is an elevation of 20 mm of Hg or more in diastolic pressure when the woman rolls over from lateral decubitus to the supine position.

**Results:** The primary outcome was that uterine artery Doppler ultrasound alone and combined together with roll over test shows a high specificity of 96.29% for prediction of PIH than Roll over test alone (77.77%). Positive predictive value of uterine artery study (91.68%) was higher than Roll over Test alone (64.70%) and almost equal when both uterine artery and Roll over Test are taken together (91.66%).

**Conclusions:** From this study we concluded that uterine artery Doppler in first and second trimester is a better predictor of PIH. Combination of Roll over test and uterine artery Doppler has similar predictive value as uterine artery Doppler than Roll over test alone.

**Keywords:** Uterine artery Doppler, Roll over test, Pregnancy induced hypertension

### INTRODUCTION

Pregnancy induced hypertension (PIH) is one of the most common complication in pregnancy and it affects up to 10 - 12% of pregnancies.<sup>1</sup> It is one of the leading causes of maternal morbidity and mortality and cause of IUGR and low birth weight babies.<sup>2,3</sup> So prevention of PIH could have salutary effects on pregnancy outcome for both the mother and child. The national incidence of PIH is 15.2% in India, while it is four times higher in primigravida women than in multipara.<sup>4,5</sup> 13% of the maternal deaths are in the women with preeclampsia and eclampsia, that

accounts for major cause of death.<sup>5</sup> The factors that have been postulated to influence the risk of pre-eclampsia among the mothers include Diabetes, Obesity, Multiple pregnancy, Primiparity, Age above 30 years, Previous history of pre-eclampsia, Family history of hypertension, Chronic hypertension.

Implantation and trophoblastic invasion of the placenta play a crucial role in its development as an organ for the transport of nutrients and oxygen to the foetus. The loss of smooth muscle and elastica from the spiral arteries converts the uteroplacental circulation into a low resistance, high capacitance system. The development of

pre-eclampsia is a consequence of impaired trophoblastic invasion to maternal spiral arteries<sup>6</sup>. The physiological process of trophoblastic invasion is reflected in the observation from Doppler ultrasound studies that impedance to flow in the uterine artery decreases between 6 weeks and 24 weeks of gestation and remains constant thereafter.<sup>7</sup>

To evaluate uterine artery Doppler wave forms, colour flow mapping is used to locate the uterine arteries as they cross from medial to the iliac arteries. The Doppler gate is placed within the straight portion of uterine artery before it enters the myometrium. A lack of endovascular infiltration by trophoblasts into the myometrial portion of the placental bed spiral arteries results in persistence of high resistance flow and early diastolic notch.

In high proportion of pregnancies destined to develop preeclampsia the uterine artery pulsatility index is increased at 11 to 13 weeks.<sup>8,9</sup> Pulsed wave Doppler should be used to cover the whole vessel and ensuring that the angle of insonation is less than 30°. When three similar consecutive waveforms are obtained the PI must be measured and the mean PI of the left and right arteries is calculated.

Thus the Doppler assessment of uterine artery flow velocity waveform can be used as a screening test for predicting the risk of pregnancy induced hypertension and its severity before onset of clinical manifestations.

**METHODS**

All Antenatal women who visit JSS hospital, Mysore and who give consent for the study are examined clinically and are subjected to Transabdominal ultrasound of uterine artery Doppler ultrasound at 11-13 weeks and rescanned at 21-24 weeks for uterine artery Doppler ultrasound and followed up for roll over test at 28-32 weeks of gestation for development of gestational hypertension, preeclampsia or eclampsia. In total 54 antenatal cases were included in the study and the study period was between November 2014 to September 2015.

Detailed general physical examination of the women along with routine hematological investigations, blood sugar levels, ABO Rh grouping, and urine examination for albumin was done.

The presence of early diastolic notch, increased pulsatility index and resistance index are considered to be a positive predictor of hypertensive disorder in pregnancy. A positive Roll Over test is an elevation of 20 mm of Hg or more in diastolic pressure when the woman rolls over from lateral decubitus to the supine position.

**Inclusion criteria**

Antenatal women after 11 weeks of gestation

**Exclusion criteria**

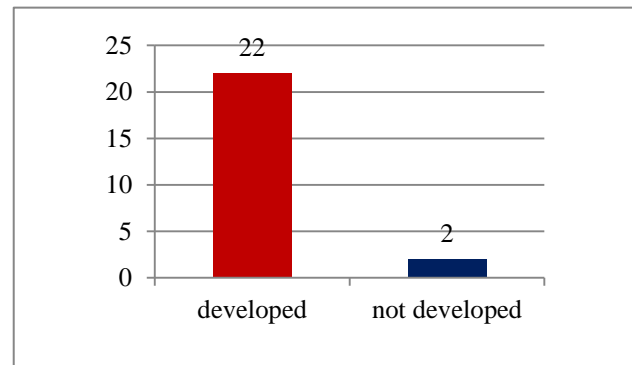
- Chronic diseases (systemic lupus erythematosus, renal causes)
- Foetal malformation or chromosomal abnormality

**RESULTS**

**Table 1: Relationship of both tests with PIH.**

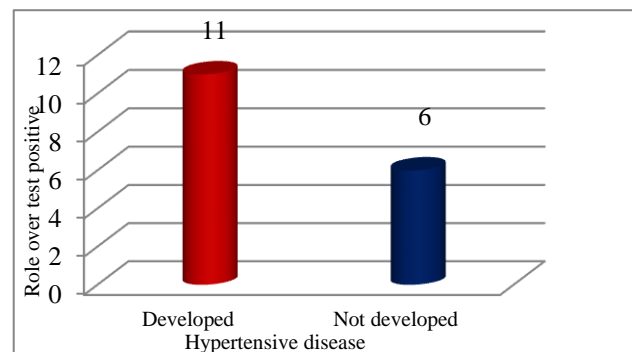
| Both roll over test and Doppler study | Who developed PIH | Not Developed PIH | Total |
|---------------------------------------|-------------------|-------------------|-------|
| Positive                              | 11                | 1                 | 12    |
| Negative                              | 16                | 26                | 42    |
| Total                                 | 27                | 27                | 54    |

Out of 54 women in our study, 27 of them developed PIH. Out of 27, gestational hypertension was 7, preeclampsia was 18 and eclampsia was 2.



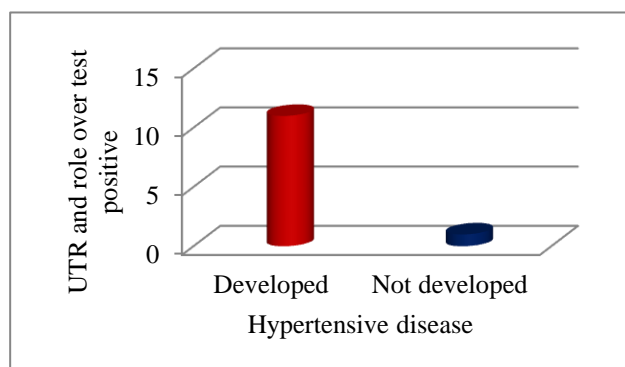
**Figure 1: Relationship of uterine artery Doppler to PIH.**

The parameters like age, gravidity, socioeconomic status, weight in relation to PIH were also taken in to account. It was observed that among the women who developed PIH were >30 yrs (37%), primigravida (53%), low socioeconomic status (92%) and weight were between 61-70 kg (64%).



**Figure 2: Relationship of roll over test to PIH.**

Out of 24 patients in whom uterine artery Doppler was positive showed that 22 of them developed PIH. Out of 17 patients in who roll over test are positive, 11 of them showed to develop PIH. Both the tests were positive in 12 of them out of which 11 of them developed PIH.



**Figure 3: Both tests combined together.**

Thus the uterine artery Doppler test gives a PPV - 91.6%, Sensitivity - 81.46%, specificity - 92.5%. The roll over test gives PPV 64.70%, Sensitivity - 40.74%, specificity - 77.77%.

When both the tests were compared together, they gave a PPV 91.6%, Sensitivity - 40.74%, Specificity - 96.29%. The sensitivity and specificity of roll over test was lower when compared to uterine artery Doppler study.

## DISCUSSION

Abnormal uterine artery Doppler studies in both the first and second trimesters have been shown to be associated with subsequent perinatal complications. For women with abnormal testing in the first trimester, the likelihood ratio (LR) for the development of preeclampsia is approximately 5, while those with normal Doppler flow studies have an LR of 0.5.<sup>10</sup>

Similarly, an abnormal test carries an LR of 2 for foetal growth restriction, with an LR of 0.9 after a normal test result. The sensitivity and specificity of screening for preeclampsia to be 81% and 87% at 20 weeks, and 76% and 95% at 24 week's gestation.<sup>11</sup>

Uterine artery Doppler screening of high-risk women (e.g., history of chronic hypertension or preeclampsia, prior foetal growth restriction, or stillbirth) with singleton gestations appears to identify those at substantially increased risk for adverse pregnancy outcomes.

**Table 2: Comparison of other studies showing uterine artery Doppler for prediction of PIH.**

| Studies                        | Sensitivity % | Specificity % | Positive predictive value | Negative predictive value |
|--------------------------------|---------------|---------------|---------------------------|---------------------------|
| Pai <sup>13</sup>              | 45.45         | 92            | 38                        | 93.87                     |
| Bower et al <sup>14</sup>      | 78            | 96            | 28                        | 99.5                      |
| Sharma Set al <sup>15</sup>    | 15.63         | 98.53         | 83.                       | 71.28                     |
| May Backos et al <sup>16</sup> | 38            | 85            | 27                        | 90                        |

Abnormal testing in these women could potentially lead to increased surveillance (earlier and more frequent assessment of foetal growth and maternal clinical condition) and interventions that might improve clinical outcomes.

The majority of research has centred on an elevation in the RI or PI, or the persistence of a uterine artery diastolic notch to detect the presence of increased uteroplacental vascular resistance. Criteria for an abnormal RI have varied from a single cut off (RI 0.58) to a percentile cut off value (75th, 90th, 95th). The faster study, a large prospective observation study, found a uterine artery Doppler RI value above the 75th percentile at 10-14 weeks' gestation to predict a 5.5-fold higher likelihood of subsequent growth restriction than those with a lower value.<sup>7</sup>

Campbell et al was the first to demonstrate a correlation between pregnancies complicated by hypertensive

disorder/FGR, increased caesarean rate, foetal distress, low APGAR scores and persistence of uterine artery notch. Furthermore, proteinuria and severe hypertension correlated significantly with persistent notch.<sup>12</sup>

Lees carried out a colour Doppler assessment of uterine artery in 5121 women attending routine antenatal clinic and concluded that persistent uterine artery notch associated with adverse perinatal outcome.

In this study, there was statistically significant association between the uterine artery Doppler findings and development of hypertensive disorders of pregnancy, when compared to no Doppler changes group. The uterine artery Doppler test gives a PPV - 91.6%, Sensitivity - 81.46%, specificity - 92.5%, which is comparable to other studies. When both the uterine artery Doppler and roll over tests were compared together, they gave a PPV 91.6%, Sensitivity - 40.74%, Specificity-96.29%.

## CONCLUSION

The study shows that uterine artery Doppler in first and second trimester is a better predictor of PIH. Combination of Roll over test and uterine artery Doppler has similar predictive value as uterine artery Doppler than Roll over test alone.

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