

## Uterine Artery Notching on Color Doppler Ultrasound and Roll over Test in Prediction of Pregnancy Induced Hypertension

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### Abstract

**Objective** To study the role of uterine artery notch on color Doppler ultrasound and roll over test in prediction of PIH.

**Methods** 100 women with high risk pregnancies were studied for presence or absence of uterine artery diastolic notch by Doppler ultrasound at 16–28 weeks. Same women were then subjected to roll over test at 28–32 weeks.

**Results** The primary outcome was that uterine diastolic notching alone and combined together with roll over test shows a high specificity (98.53%) for predicting PIH than roll over test (76.47%) alone. PPV of uterine artery diastolic notching (83.33%) was higher than roll over test alone (54.29%) and both tests combined together (80%).

**Conclusion** After analyzing all the results, it has been concluded that uterine artery Doppler notching is better

predictor for PIH than roll over test or even combined Doppler + Roll over test together.

**Keywords** Uterine artery notching · Color Doppler · Roll over test · Pregnancy induced hypertension

### Introduction

Pregnancy induced hypertension (PIH) is the most common complication of pregnancy and it affects up to 12% of pregnancies [1]. It is one of the leading causes of maternal morbidity and mortality [2]. Also it is the leading cause in 23% of all viable low birth weight babies [3]. So prevention of PIH could have salutary effects on pregnancy outcome both for mother and child.

Incidence of PIH is about 5%. It is more common at either end of reproductive age, influenced by parity, race, and socioeconomic status, previous history of PIH and family history. It is 5 times more common in twin pregnancies especially dizygotic twins. PIH is 12% in both diabetics and in gestational diabetics.

Doppler ultrasound evaluation of uterine artery impedance in the second trimester has been used as an early screening test for preeclampsia [4]. Uterine artery Doppler wave form is unique and characterized by high diastolic flow velocities. Increased resistance to flow and development of a diastolic notch have been associated with PIH [5].

Doppler ultrasound provides a non-invasive method for the study of the uteroplacental circulation. The characteristic

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shape of uterine waveform shows a steep systolic slope, an early diastolic notch and a small amount of diastolic flow. The waveform is essentially a high resistance form in the non-pregnant state. As the pregnancy progresses, there is gradual removal of the notch and an increase in the diastolic flow, as seen by the fall in resistance index (RI).

By using the persistence of the notch of the uterine arteries as the definition of abnormality, it was found that it persists in the majority of the women diagnosed with PIH.

### Aims and Objectives

The purpose of the present study is to study the predictive value of uterine artery diastolic notch on color Doppler at 16–28 weeks gestation and “Rollover” test at 28–32 weeks of gestation individually, and combined together, for prediction of PIH.

### Materials and Methods

100 women with high risk pregnancies including primi-gravidas, women with family history of PIH, previous history of PIH, eclampsia, APH (abruption), gestational diabetes, chronic hypertension, Rh incompatibility, polyhydramnios, oligohydramnios, anhydramnios, twin pregnancy, chronic nephritis, teenage pregnancy, severe anemia, elderly primigravidas, grand multipara and previous bad obstetric history were studied.

Detailed general physical examination of the women along with routine hematological investigations, blood sugar levels, ABO Rh grouping, renal function tests, hepatic function tests, fundus oculi examination, urine examination for albumin was done.

Detailed antenatal examination was done on all women. They were then subjected to Doppler ultrasound at 16–28 weeks to evaluate the presence or absence of notch in the uterine artery. Same woman was then subjected to “Rollover test” at 28–32 weeks.

The rollover test is a non-invasive office procedure. A positive test is an elevation of 20 mm of Hg or more in blood pressure when the woman rolls over from lateral decubitus to the supine position at 28–32 weeks of gestation.

### Observations

Out of a total of 100 women, the number of women who developed PIH were 32. Out of these 32 women, three were found to have gestational hypertension, 28 had preeclampsia and 1 woman developed eclampsia.

The observations were recorded considering—age, gravida, socio-economic status, anemia, and weight

relationship with PIH. It was observed that majority of women who developed PIH were between age of 31–35 years (66.66%), third gravidas (58.33%), anemic (hemoglobin levels below 8 g%) (83.33%), belonged to lower socioeconomic group (39.65%), and had weight between 61 and 70 kg (70.37%).

### Relationship of Presence or Absence of Diastolic Notch in Uterine Artery Waveform at 16–28 Weeks of Gestation to PIH

Of the 6 women who had diastolic notch, only 5 developed PIH. The test gave PPV—83.33%, NPV—71.28%, sensitivity—15.63% and specificity—98.53% (Table 1).

### Relationship of Rollover Test to PIH

Of the 65 women who showed negative roll over test, 13 women developed PIH and 52 women remained normotensive, giving a NPV of 80%, sensitivity 59.38%, specificity 76.47% and PPV 54.29% (Table 2).

### Relationship of PIH with Rollover Test and Uterine Artery Diastolic Notch Combined Together

Both tests combined together had a PPV of 80%, NPV 70.53%, sensitivity 12.50% and specificity 98.53% (Table 3).

### Discussion

In our study, out of 100 women, 32 women developed PIH (incidence—32%) and 68 women remained normotensive throughout. Out of these 32 women, three were found to have gestational hypertension, 28 had preeclampsia and one woman developed eclampsia. This incidence is higher

**Table 1** Showing relationship of diastolic notch in uterine artery waveform to PIH

Presence/absence of diastolic notch	Women developing PIH	Women not developing PIH	Total
Notch present	5 (83.33%)	1 (16.66%)	6 (6%)
Notch absent	27 (28.72%)	67 (71.27%)	94 (94%)
Total	32	68	100

**Table 2** Showing relationship of rollover test to PIH

Result of rollover test	Women developing PIH	Women not developing PIH	Total
Positive	19 (54.29%)	16 (45.72%)	35 (35.00%)
Negative	13 (20.00%)	52 (80.00%)	65 (65.00%)
Total	32	68	100

**Table 3** Showing relationship of PIH with rollover test and uterine artery diastolic notch combined together

Rollover test and diastolic notch	Women developing PIH	Women not developed PIH	Total
Positive	4	1	5
Negative	28	67	95
Total	32	68	100

than most studies done previously, as our study was carried out in a tertiary centre, taking only high risk pregnancies.

Incidence of PIH as reported by various authors is 5–10% [6], 11% [7], 12–20% [8] and 3–14% [9].

The sensitivity of uterine artery diastolic notch in our present study was found to be 15.63%, specificity 98.53%, PPV 83.33% and NPV 71.28%. Our result is comparable to that found in study by Bewley et al. [10] (sensitivity 24%, specificity 95%) and by Zimmerman et al. [11] (sensitivity 22%, specificity 90%). The disparity in PPV and NPV of our study and in various studies done previously is probably because of variation in the study population.

The sensitivity of roll over test was found to be 59.38%, specificity 76.47%, PPV 54.29% and NPV 80.00%. These observations are in accordance with the study done by Kuntz [12]. Combined together the two tests had sensitivity 12.50%, specificity 98.53%, PPV 80.00% and NPV 70.53%.

Until there is a better knowledge of the etiology and pathogenesis of PIH, a preventive approach is suggested. Though it is not conclusive that rollover test and the presence/absence of diastolic notching in the uterine artery have a positive role in predicting the occurrence of PIH, combined together they still form an important part of the investigative process for early detection and timely management of disease process.

## Conclusion

The incidence of PIH in the study is 32%. Out of these 32 women, three were found to have gestational hypertension, 28 had preeclampsia and one woman developed eclampsia. 68% of the women were normotensive.

PIH was seen more in the age group of 31–35 years (66.67%), para 3 (58.33%), maximum with hemoglobin less than 8 g%.

Diastolic notch on uterine artery Doppler ultrasound as a predictor for development of PIH was found to have: sensitivity (15.63%), specificity (98.53%), PPV (83.33%), NPV (71.28%).

Rollover test as a predictor for development of PIH was found to have: sensitivity (59.38%), specificity (76.47%), PPV (54.9%), NPV (80.00%).

Both the tests combined together, when used for the prediction of development of PIH were found to have: sensitivity (12.50%), specificity (98.53%), PPV (80.00%), NPV (70.53%).

After analysis of the results and comparison with the reports of previous workers, it has been established that uterine artery diastolic notching shows a high specificity for predicting PIH than rollover test. Combined together both the tests also show specificity as high as uterine artery notching alone. PPV of uterine artery diastolic notching is found to be 83.33%, which is higher than the PPV of both tests combined together (80.00%). Rollover test shows a much lower PPV of 54.29%.

This is, by and large, an endeavor to assess the predictive value of two tests for development of PIH. Our results don't exactly correspond with any of the international studies conducted previously. This can be attributed to the fact that our study population includes only high risk cases attending the out-woman department of a tertiary care centre in an Indian setup.

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