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**Original Research Article**

# Third trimester Doppler ultrasound as prediction of obstetric outcome in high-risk pregnancy, Gujarat, India

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## ABSTRACT

**Background:** Doppler ultrasound has emerged as beneficial tool in the assessment of the fetal and placental circulation and in the prediction of adverse pregnancy outcome. Umbilical artery Doppler has proved helpful to supervise the growth restricted fetuses and compromised vasculature as in hypertensive disorders high risk pregnancies. Objective of present study was to investigate the association between third-trimester uterine artery Doppler assessment and adverse obstetric outcome.
**Methods:** This prospective study was done among 110 high risk pregnancies. Vessel like uterine artery, umbilical artery, middle cerebral artery and ductus venosus were studied in present study. Indices calculated: Peak systolic velocity, End diastolic velocity, Mean velocity, Systolic/diastolic ratio, Pulsatility index (PI) and resistance index (RI) of middle cerebral artery (MCA), Ductus venosus S/A ratio.
**Results:** bilateral notch was present statistically significant ($p<0.05$) in 18.1% and absent in 28.2% among cases of adverse perinatal outcome. UA S/D ratio was >3 in 22.7% and <3 in 11.8% among cases of adverse perinatal outcome and findings were statistically significant ($p<0.05$). End diastolic velocity was reduced in statistically significant ($p<0.05$) in 9.1% and normal in 20.1% among cases of adverse perinatal outcome. MCA PI was <lower limit statistically significant ($p<0.05$) in 24.5% and >lower limit in 18.2% among cases of adverse perinatal outcome. MCA PI/UA PI ratio was <1 statistically significant ($p<0.05$) in 25.5% and absent in 17.3% among cases of adverse perinatal outcome.
**Conclusions:** Increase in UA PI and decrease in MCA PI are early marker for detection of fetal compromise. Ratio of indices between MCA PI and UA PI reflects brain sparing effect as well as placental insufficiency and these are more specific in detection of IUGR than individual artery indices.

**Keywords:** Bilateral diastolic notches, Pre-eclampsia, Perinatal outcome, Uterine artery Doppler

## INTRODUCTION

Doppler ultrasound has emerged as beneficial tool in the assessment of the fetal and placental circulation and in the prediction of adverse pregnancy outcome.[1,2] Doppler knowledge has been identifying to decrease the figure of emergency operations, hospital admissions, and days in hospital for both mother and newborn in cases of suspected IUGR.[3] During first and second trimester, an ultrasound examination is used to the fetal malformations and to assess fetal growth disorders.[4] Almost 4-10% pregnant women suffered from pre-eclampsia (PE) and intrauterine growth restriction (IUGR) which resulted in maternal morbidity and premature iatrogenic deliveries. Since many years, lots of studies done on Doppler ultrasound have found that increased blood flow resistance in the uterine arteries is associated with increased risk of PE and/or IUGR and other adverse

perinatal outcomes.[5,6] Doppler of uteroplacental circulation plays a important part in treatment of high-risk pregnancies. It helps one to determine the fetus at risk and at time of delivery. Umbilical artery Doppler has proved helpful to supervise the growth restricted fetuses and compromised vasculature as in hypertensive disorders high risk pregnancies. However, number of studies proved that uterine artery Doppler useful even in the third trimester to identify adverse perinatal outcome.[7,8] The aim of present study was to investigate the association between third-trimester uterine artery Doppler assessment and adverse obstetric outcome.

## METHODS

This prospective study was done among 110 high risk pregnancies admitted at department of obstetrics and Gynecology in B.J. Medical college, Ahmedabad during July 2008 to October 2012. Data collection was done after ethical permission from institutional ethical committee and informed consent of clients.

Inclusion criteria for present study was all pregnant women irrespective of age and parity with high risk factors like preeclampsia, oligohydramnions, anemia and renal disease etc.

Exclusion criteria was women with multiple pregnancy, congenital malformation and placenta previa, abruptio placenta etc. Vessel like uterine artery, umbilical artery, middle cerebral artery and ductus venosus were studied in present study. After taking detail history, a thorough clinical examination of the clients was carried out with preliminary investigations like SGPT, SGOT, Serum total protein, S. uric acid and fundoscopy. EDD was calculated from LMP and by USG done in first trimester of pregnancy.

1. Ultrasound scanning: after ensuring single live pregnancy, lie, presentation, gestational age, amount of liquor, placental localization and maturation, any congenital anomalies, presence or absence of IUGR were recorded.

2. Doppler velocimetry: It was done beyond 28 weeks of gestation in all patients, repeated after 2 weeks or earlier if and when required

3. Indices calculated:
- Peak systolic velocity
- End diastolic velocity
- Mean velocity
- Systolic/diastolic ratio
- Pulsatility index (PI) and resistance index (RI) of middle cerebral artery (MCA)
- Ductus venosus S/A ratio

4. Interpretation of Doppler findings
- Uterine artery having bilateral diastolic notches
- Umbilical artery S/D ratio more than 3 or more than 95 percentile of reference value, pulsatality index more than 95 percentile of reference value or if the diastolic flow was absent or reversed
- Middle cerebral artery PI less than lower limit of reference value
- MCA/UA PI ratio less than 1 of reference value
- MCA/UA S/D ratio than 1
- DV having absent or reversed flow as seen in 'a' wave

5. Follow up of patients:
- With normal Doppler follow up till delivery
- With abnormal Doppler weekly or earlier

6. For neonatal information like mode of delivery, indication of caesarean section, APGAR score at 5 and 10 minutes, antepartum/intrapartum sign of fetal distress, birth weight, admission to intensive care unit, any intrauterine death or still birth, gestation age at birth.

## RESULTS

Table 1 shows that mean maternal age was 26.8 years with 5.9 SD and more than 50% participants belonged to 21 to 25 years age group.

Almost 51.0% participants were primigravida and 53.6% birth was done through vaginal route. Fetal distress was the main indication for caesarian section. Mean birth weight was 2150 gm with 256.7 SD.

**Table 1: Patient characteristics and pregnancy outcome (N=110).**

| Parameters | Number (%) |
|---|---|
| Maternal age (Mean±SD) | 26.8±5.9 |
| Maternal age (21-25 years) | 57 (51.8%) |
| Gravidity | |
| Primi | 56 (51.0) |
| Multi | 54 (49.0) |
| Mode of delivery | |
| Vaginal | 59 (53.6) |
| Caesarean | 51 (46.4) |
| Indication for caesarean section | |
| Fetal distress | 33 (60.0) |
| Severe pre-eclampsia | 5 (9.1) |
| Other | 17 (30.9) |
| Birth weight (gm) | |
| <2500 | 51 (46.4) |
| 2500-4000 | 57 (51.8) |
| >4000 | 2 (1.8) |
| Mean birth weight (gm) (Mean±SD) | 2150±256.7 |

**Table 2: Distribution of cases in relation to pregnancy complication.**

| Pregnancy complication | Number (%) |
|---|---|
| Oligohydramnios | 60 (54.5) |
| SFGR | 53 (48.2) |
| Pre-eclamsia | 36 (32.7) |
| Anemia | 21 (19.1) |
| PIH+Oligo | 11 (10.0) |
| Post-dated pregnancy | 6 (5.5) |
| PIH+Anemia | 6 (5.5) |
| Cardiac disease | 3 (2.7) |
| Anemia+Oligo | 2 (1.8) |
| Bad obstetric history | 2 (1.8) |
| Renal disease | 1 (0.9) |
| Liver disease | 1 (0.9) |

Table 2 shows that Oligohydramnios, SFGR, Pre-eclamsia, Anemia are the most common pregnancy complications respectively.

**Table 3: Association of Doppler ultrasound findings with perinatal outcome (N=110).**

| Doppler ultrasound findings | Perinatal outcome | | p value |
|---|---|---|---|
| | Adverse | Normal | |
| **Bilateral notch** | | | |
| Present | 20 (18.1) | 8 (7.3) | 0.004 |
| Absent | 31 (28.2) | 51 (46.4) | |
| **UA S/D ratio** | | | |
| >3 | 25 (22.7) | 13 (11.8) | 0.0001 |
| <3 | 13 (11.8) | 59 (53.7) | |
| **End Diastolic velocity** | | | |
| Reduced | 10 (9.1) | 6 (5.5) | |
| AEDF | 8 (7.3) | 0 (0.0) | 0.0001 |
| REDF | 9 (8.2) | 0 (0.0) | |
| Normal | 23 (20.1) | 54 (49.1) | |
| **MCA PI** | | | |
| <lower limit | 27 (24.5) | 14 (12.3) | 0.0003 |
| >lower limit | 20 (18.2) | 49 (44.5) | |
| **MCA PI/UA PI ratio** | | | |
| <1 | 28 (25.5) | 5 (4.5) | 0.0001 |
| >1 | 19 (17.3) | 58 (52.7) | |

Table 3 shows that bilateral notch was present statistically significant ($p<0.05$) in 18.1% and absent in 28.2% among cases of adverse perinatal outcome. UA S/D ratio was >3 in 22.7% and <3 in 11.8% among cases of adverse perinatal outcome and findings were statistically significant ($p<0.05$).

End diastolic velocity was reduced in statistically significant ($p<0.05$) in 9.1% and normal in 20.1% among cases of adverse perinatal outcome. MCA PI was <lower limit statistically significant ($p<0.05$) in 24.5% and >lower limit in 18.2% among cases of adverse perinatal outcome. MCA PI/UA PI ratio was <1 statistically significant ($p<0.05$) in 25.5% and absent in 17.3% among cases of adverse perinatal outcome.

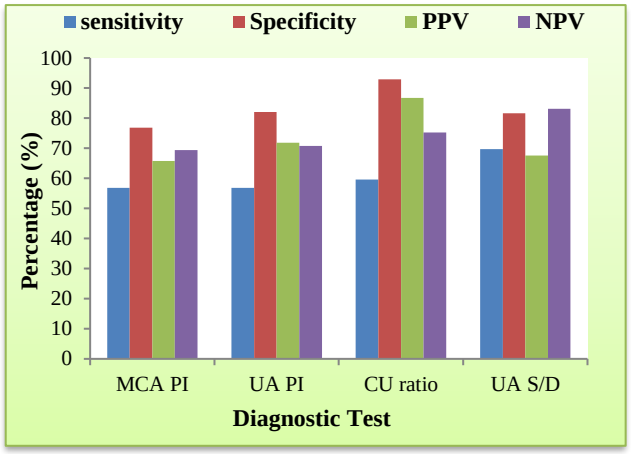


**Figure 1: Comparison of standard diagnostic test in prediction of abnormal perinatal outcome**

Figure 1 shows that abnormal perinatal outcome correctly found in 56.8%, 56.8%, 59.6% and 68.7% cases by MCA PI, UA PI, CU ratio and UA S/D ratio test respectively. Specificity to find abnormal perinatal outcome was 76.8%, 82.1%, 92.9% and 81.6% cases by MCA PI, UA PI, CU ratio and UA S/D ratio test respectively.

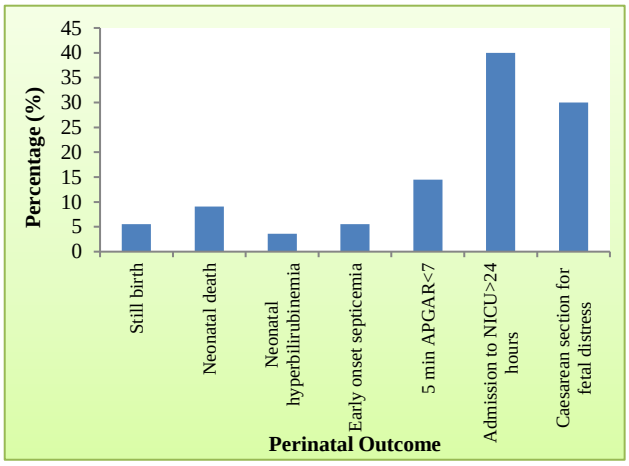


**Figure 2: Perinatal outcome among study participants**

Figure 2 shows that most common adverse perinatal outcome was admission in NICU >24 hours, fetal distress, APGAR score <7, Neonatal death respectively.

Abnormal ductus venosus was found abnormal flow pattern in 6 cases and all these 6 cases have adverse perinatal outcome was observed.

## DISCUSSION

The relation between adverse perinatal outcome and intrauterine growth restriction, oligohydramnios and adverse outcome is well known and lots of research found that uterine artery Doppler very useful in the prediction of uteroplacental insufficiency from early and late gestation.[9,10]

Mean maternal age in present study was 26.8 years and these findings are consistent with the similar study done by wald RM et al, Garcia et al and Rai L et al.[11-13] Study included similar number of participants of primigravida and multigravida. Caesarean section was reportedly less in number in comparison with vaginal delivery and fetal distress eas the main indication for caesarean section. These findings are comparable with the findings of study done by Rai L et al and Garcia B et al.[12,13] Mean birth weight in present study was 2150 gm but these findings are not comparable with similar study done by Wald RM et al, Garcia B at al, Peixoto et al and Li H et al.[6,11,12,14] Oligohydramnios, SFGR, Pre-eclamsia, Anemia are the most common pregnancy complications respectively.

Ultrasound doppler screening is the relatively low detection rate, especially for late-onset cases during second trimester of pregnancy.[12] Present study found statistically significant association between adverse perinatal outcome with presence of bilateral notch in uterine artery doppler, UA S/D ratio, end diastolic velocity, MCA PI and MCA PI/UA PI ratio. Hofstaetter et al reported uterine artery notch to be a better predictor of perinatal outcome than unilateral high PI.[15] This is in contrast to the findings of Ghosh et al where RI and PI were considered better indicators of vascular impedance in predicting adverse perinatal outcomes.[16]

B/L notch in uterine artery Doppler was present in 25.4% participants and this findings are quit comparable with the similar study done by Wald RM et al, Rai L et al but not consistent with study done by Maria AL et al and Li H et al.[11,13,14,17] Study found acceptable sensitivity, specificity, PPV and NPV of Doppler ultrasound during third trimester to predict obstetrical and perinatal outcome and this findings are comparable with study done by Rai L et al.[13]

Limitations of this study was number of cases has been small and study not included Patients who came in labor or with a complication like abruptio placenta.

## CONCLUSION

The use of Doppler ultrasound in high risk pregnancies appears to improve a number of obstetric care outcomes and appear promising in helping to reducing perinatal deaths. Increase in UA PI and decrease in MCA PI are early marker for detection of fetal compromise. Ratio of indices between MCA PI and UA PI reflects brain sparing effect as well as placental insufficiency and these are more specific in detection of IUGR than individual artery indices.

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