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**Dr. Phaneendra Kolla**  
Assistant Professor,  
Department of Radio-  
Diagnosis, Shadan Institute of  
Medical Sciences, Teaching  
Hospital and Research Centre,  
Hyderabad, Telangana, India

## Role of uterine artery, umbilical artery & middle cerebral artery doppler in pregnancy induced hypertension & pregnancy induced hypertension with intrauterine growth retardation & its neonatal outcome

**Dr. Phaneendra Kolla**

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### Abstract

**Purpose:** Intra uterine growth retardation (IUGR) due to fetoplacental vascular insufficiency is rampant in developing countries like India. Owing to the lack of awareness, antenatal patients often present in their third trimester for their first ultrasound examination. Alterations in the waveforms and Doppler indices of fetal middle cerebral artery (MCA), umbilical artery and bilateral uterine arteries have been extensively described in various studies in the literature.

**Aim & Objective:** This prospective study was performed to determine the role of uterine artery umbilical artery & middle cerebral artery doppler in pregnancy induced hypertension & pregnancy induced hypertension with intrauterine growth retardation & its neonatal outcome.”

**Method:** A prospective study was done on 100 patients of clinically suspected IUGR/high-risk pregnancies of 31–41 weeks. The cases were followed till delivery; the doppler and grey scale findings were correlated with the birth weight of the baby.

**Results:** Out of the 100 cases in our study (majority) 55 patients were between 21-25 age. 43% were between 32-36 weeks gestation, 61% patient had grade 2 placenta, 39% had grade 3 placenta and 37% had anterior placentation. Majority of patients (46%) are primigravida. 61% had oligohydramnios. Majority of patients having preeclampsia with IUGR contribute to 58%, there was significant association between abnormal doppler and caesarean section. There is significant association between doppler study result of umbilical artery and perinatal outcome (p=0.0037). There is significant association between doppler study of middle cerebral artery and perinatal outcome. (P=0.0001).

**Conclusions:** Abnormal PI of MCA/ UMBILICAL artery ratio is also associated with IUGR. CPR is more sensitive than MCA and umbilical artery individually. Thus abnormal triple vessel doppler study is very useful in predicting high risk pregnancies with adverse perinatal outcome.

**Keywords:** Intra uterine growth retardation, umbilical artery, ultrasonography, middle cerebral artery

### Introduction

Intrauterine growth restriction (IUGR) is associated with an increased risk of perinatal mortality, morbidity, and impaired neurodevelopment. Ultrasonographic (US) biometry helps to identify a heterogeneous group of small– for– gestational age foetuses that include foetuses with IUGR, foetuses with small constitution, and foetuses with appropriate growth (misdiagnosed as small). Umbilical arterial (UA) Doppler velocimetry is the most thoroughly assessed test amongst non-invasive trial of fetal health<sup>[1]</sup>. A meta-investigation of randomized controlled trials of UA Doppler velocimetry in high-chance pregnancies (for the most part pregnancies with related hypertension and suspected IUGR) showed that its utilization was related with a pattern to the reduction of perinatal mortality, in spite of the fact that there was no impact on the rate of neonatal morbidity<sup>[1, 2]</sup>. Consequences of a few examinations recommend that the MCAPI/UAPI Doppler proportion is more precise in the anticipation of antagonistic perinatal result than UA Doppler only US. 2-4 Our investigation was an attempt at building up the part of UA and MCA Doppler ultrasound in foreseeing unfavourable perinatal out come in clinically presumed IUGR pregnancies, and to decide the part of Doppler velocimetry in clinical administration of such pregnancies.

**Corresponding Author:**  
**Dr. Phaneendra Kolla**  
Assistant Professor,  
Department of Radio-  
Diagnosis, Shadan Institute of  
Medical Sciences, Teaching  
Hospital and Research Centre,  
Hyderabad, Telangana, India

### Aims and Objectives of the present study

1. To evaluate the role of doppler velocimetry in the management of patients with GHTN and GHTN variants with IUGR.
2. To study the pattern of blood flow in uterine artery, umbilical artery and middle cerebral artery using doppler velocimetry in patients with gestational hypertension, and gestational hypertension, and gestational hypertension variants with IUGR
3. To analyse the perinatal outcome in patients with gestational hypertension and gestational hypertension with IUGR using doppler velocimetry.

### Materials and methods

This is a prospective study done over a period of 1 year 10 months in our Shadan Hospital. 100 cases with gestational hypertension and gestational hypertension with IUGR, were subjected to uterine, umbilical and middle cerebral arteries doppler along with morphology and biometric scan.

### Inclusion criteria

1. Pregnancy should be between 28-40 weeks.
2. Singleton pregnancies, with history & physical findings suggestive of gestational hypertension and gestational hypertension and IUGR.

### Exclusion criteria

1. Patients with no risk factors.
2. Patient with congenital anomaly of foetus, multiple gestations, chronic hypertension, renal and cardiac disease.
3. Exclude patients with unreliable LMP, those who are not booked cases at our hospital, patients with intrauterine death at the time of first doppler examination.

### Procedure

Data collected by Siemens Acuson x300 usg Machine with color doppler using convex probe 3.5Mhz frequency. Fetal biometry and morphology, color doppler was done in supine position in longitudinal plane. The flow velocity waveforms were obtained by angling the probe medially to identify the uterine artery on both the sides.

Fetal thalamus visualised in BPD view using color doppler MCA flow velocity waveforms are obtained. The flow velocity waveforms are obtained from free loops of umbilical artery in umbilical cord. Parameters studied are S/D ratio, PI and RI in uterine, umbilical arteries and MCA, early diastolic notch in uterine artery. Patients with abnormal waveforms were followed up till delivery and details of pregnancy event, labour and delivery and the neonatal outcome were noted.

### The abnormal outcomes

1. Gestational hypertension which was subdivided into. A) Preeclampsia (proteinuric GHTN), (hypertension  $>140/90$  mm hg on at least 2 occasions, proteinuria  $>1$  +albumin on dipstick method).
2. **Non proteinuric GHTN:** IUGR defined as  $<10^{\text{th}}$  percentile weight for the gestation age.

### Observation and results

Out of the 100 cases I our study (majority) 55 patients were between 21-25 age. 43% were between 32-36 weeks

gestation, 61% patient had grade 2 placenta had 39% had grade 3 placenta and 37% had anterior placentation. Majority of patients (46%) are primigravida. 61% had oligohydramnios.

**Table 1:** Age Distribution

Age distribution	Number	%
21-25	55	55
26-30	45	45

**Table 2:** Maturity of the placenta

Placental Maturity	Number	%
Grade II	61	61
Grade III	39	39

**Table 3:** Nature of the Gravida

Gravida	Number	%
Primigravida	46	46
oligohydramnios	61	61

**Table 4:** Table showing Adverse Outcomes

Adverse outcomes	Number	%
Low birth weight	58	58
NICU admission	52	52
Preterm delivery	30	30
Low APGAR score	24	24
Neonatal deaths	06	06

**Table 5:** Table showing Predictive Values of Doppler Indices

Doppler index	PPV
UA	84.5%
MCA	87%
CA	89%

Majority of patients having preeclampsia with IUGR contribute to 58%, there was significant association between abnormal doppler and caesarean section.

69% of foetuses had at least one abnormal outcome and remaining 31% foetuses had normal outcome, out of the total 100 cases, 58 had low birth weight, 52 needed NICU admission, 30 were preterm delivery, low APGAR score in 24, neonatal death observed in 6 foetuses. Doppler results considered abnormal for umbilical and middle cerebral arteries together are significantly associated with low birth weight. 64% of cases were abnormal Doppler wise. There is significant association between doppler study result of umbilical artery and perinatal outcome (p-0.0037). There is significant association between doppler study of middle cerebral artery and perinatal outcome. (P-0.0001).

### Discussion

We have studied about 100 pregnancies with gestational hypertension and clinical and sonologically evaluated IUGR. 69 neonates had birth weight of less than 2.5kg, 46 neonates were admitted to NICU, 24 had 5min Apgar score of less than 7 and 31 babies were born by emergency caesarean section for fetal distress. The normal and abnormal doppler wise distribution of cases in the present study group and reference studies was done. In study done by Bhatt CJ *et al.* [3] showed that normal were 44% and 56% were abnormal. In study by U. Gupta *et al.* [4] 45% were normal and 55% were abnormal. Our study showed 36% normal and 64% abnormal doppler.

**Umbilical artery:** it was found to have low sensitivity of 65.1% when compared to MCA PI and cerebroplacental ratio. The sensitivity of our study (65.1%) was comparable with that of Torres *et al.* (62.5%) and Gramellini *et al.* [5] (64%). The specificity of UA PI 95.1% was found to be better than MCA PI and cerebral placental ratio. The specificity (95.1%) was exactly comparable with the Torres *et al.* study (95.1%). The positive predictive value of UA PI 84.5% which is more than that of MCA PI and cerebroplacental ratio. Our study is correlating with study of Battacharya *et al.* [6] this indicates the likelihood of perinatal adverse outcome I pathologically growth restricted fetuses with abnormal UA PI. The negative predictive value 79.4% in our study was comparable with study of Fong *et al.* [7] our findings confirms the results of Fong KW *et al.* [7] and Gramellini *et al.* [5] that abnormal UAPI is associated with adverse outcome like NICU admission for low birth weight and low APGAR scores than the one with fetus normal with UA PI. This provides information for differentiating fetuses already compromised or likely to become compromised from those that are non-compromised. 100% perinatal mortality was seen in our study in patients with reversal of end diastolic flow and absent end diastolic flow in umbilical artery, our study is comparable to B N Lakhkar *et al.* [8] study.

**Middle cerebral artery:** It is found to have a sensitivity of 82.3% less than that of cerebroplacental ratio and more than UA PI. The specificity of MCA PI in our present study (87%) is less specific than cerebroplacental ratio and UA PI. It agrees with Fong *et al.* [7] that MCA PI is less specific than cerebroplacental ratio and UA PI. Positive predictive value of MCA PI 90.1% in predicting adverse perinatal outcome is more than that for other variables.

**Cerebroplacental ratio:** it had the highest sensitivity value of 93% more than MCA PI and UA PI. The highest sensitivity of cerebroplacental ratio indicates its usefulness in ruling out adverse perinatal outcome in IUGR. The specificity value in present study is 88% which is less than UA PI and better than MCA PI. The positive predictive value of present study is 89%. The value is not comparable with Gramellini *et al.* study [5]. The negative predictive value 84% is better than that of UA PI and MCA PI. The values were comparable with that of Fong *et al.* study [7]. In our study we compare the overall diagnostic accuracy in prediction of adverse outcome in IUGR. Cerebroplacental ratio has the diagnostic accuracy of 89% which is more than UA PI (83%), MCA PI (85%). Values are comparable with that of Gramellini *et al.* [5]. Present study has shows all the cases with abnormal umbilical artery S/D ratio, which is approximately comparable to the study by Fleisher *et al.* [9]. Our present study showed majority of the cases (80%) with abnormal doppler indices had NICU stay, comparable with Ghosh *et al.* [10] study 86% of NICU admissions with abnormal doppler indices. Perinatal morbidity in abnormal uterine artery S/D and abnormal umbilical artery S/D are respectively 25% and 100%. our results in evaluating the usefulness of umbilical artery and middle cerebral artery doppler in predicting the adverse perinatal outcome in preeclampsia and IUGR indicate that both abnormal umbilical doppler indices and cerebral-umbilical ratio are strong predictors of adverse outcome in IUGR. MCA PI alone is not a reliable indicator when used alone. The

combination of umbilical and fetal cerebral doppler indices may increase the utility of doppler ultrasound in clinically suspected IUGR.

### Conclusion

Doppler ultrasound is safe non-invasive outpatient technique, easy to perform and interpret and most valuable tool in management of high risk pregnancy. Doppler velocimetry is a primary tool for fetomaternal surveillance in hypertensive pregnancy and it can assess changes. In uterine umbilical and MCA circulation which can correlate with perinatal outcome. Pre-eclampsia is associated with significant fetal morbidity and mortality. Abnormal uterine, umbilical and MCA doppler velocimetry studies are associated with severe forms of HTN and high incidence of IUGR. Absent end diastolic flow and reverse diastolic flow in umbilical artery indicates severe fetal distress and is associated with 100% perinatal mortality.

- Due to abnormal doppler indices there was high incidence of LSCS due to fetal distress, low birth weight, low APGAR score at 1 and 5 minutes and increased NICU admissions.
- Abnormal PI of MCA/UMBILICAL artery ratio is also associated with IUGR. CPR is more sensitive than MCA and umbilical artery individually.
- Thus abnormal triple vessel doppler study is very useful in predicting high risk pregnancies with adverse perinatal outcome.

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