

# ” COLOUR DOPPLER STUDY OF THIRD TRIMESTER HIGH RISK PREGNANCY FOR THE DIAGNOSIS AND PROGNOSIS OF IUGR”

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## **Introduction:**

Intrauterine growth restriction (IUGR) is a major public health concern in developing countries like India, IUGR is an leading cause of perinatal morbidity and mortality and has major impact on growth of children health, statistic parameter of maternal and child health in India has shown improvement in past few year. doppler study of umbilical, uterine and middle cerebral artery play a major role in early detection and prompt management and has crucial role in decreasing perinatal mortality and morbidity.

IUGR is defined as birth weight below 10<sup>th</sup> percentile for gestational age on the appropriate population growth curve and it is most commonly due to by placental insufficiency, in response to which the fetus adapts its circulation

to preserve oxygen and nutrient supply to the brain ('brain-sparing'). In the situation of chronic fetal hypoxemia or nutrient deprivation, the fetus redistributes its cardiac output to maximize oxygen and nutrient supply to the brain (brain-sparing). There is cerebral vasodilation and lowered cerebral vascular resistance which led to increased end-diastolic flow velocity in the cerebral arteries and is detected by Doppler sonography. IUGR are associated with an increased placental vascular resistance this in term changes seen in uterine and umbilical arteries.

**Aims and Objectives:** To evaluate the role of color doppler study in assessment of IUGR and its diagnostic accuracy in predicting perinatal outcome and its role in management

**Material and Methods:**

Patients referred to our department for assessments of IUGR in suspected high-risk third trimester pregnancies are included in our study and study conducted over a period of two year.

**Inclusion criteria-**

- 1- The gestational age of patients was between 28 to 41 weeks
- 2- Singleton pregnancy
- 3- The patients with high-risk pregnancy or clinically or radiologically diagnosed case of IUGR
- 4- Live fetus with no sign of chromosomal abnormality
- 5- Birth at institution

**Exclusion criteria-**

- 1- Fetus with congenital anomalies
- 2- Multiple pregnancies
- 3- Gestational age less than 28weeks

**Results:**

121 women entered this prospective study over a period of 2year, statistical analysis was done on 110patient as they delivered in our hospital, 11 patients were excluded from the study as they did not at our institution.

**TABLE-1**  
**Distribution of cases based on etiology**

<b>Etiology</b>	<b>No of Cases</b>	<b>Percentage (%)</b>
Idiopathic	25	22.72%
Gestational Hypertension	36	32.72%
Anemia	16	14.54%
Heart Disease	5	4.5%
Placenta previa	11	10%
Chronic maternal disease	9	8.18%
Miscellaneous	2	1.81%
Gestational diabetic	6	5.4%
Total	100	

It is seen that 32.72% had H/O hypertension on pregnancy whereas 22.72% had no specific history, 14.54% had associated anemia.

**Table- 2**

**Type of uterine artery abnormality and associated Perinatal outcome**

Doppler flow Pattern	outcome		Mortality	Morbidity
	Normal	Abnormal		
Normal(71)	41	30	18	12
Abnormal(39)	13	26	14	12
U/L high resistance(17)	7	10	3	7
B/L High resistance(13)	4	9	5	4
U/L Notch(7)	2	5	4	1
B/L Notch(2)	0	2	2	0

Normal uterine artery doppler flow was associated with 55.54% good perinatal outcome and 42.25% had abnormal outcome. The neonatal mortality was 25% and neonatal morbidity was 16.90%.

When uterine artery was abnormal 33.33% cases had good perinatal outcome, 66.67% had abnormal perinatal outcome, perinatal mortality being 35.89% and morbidity being 30.76%

High resistance flow in a single uterine artery was associated with abnormal outcome in 58.82% cases and 17.64% was mortality rate.

High resistance flow in each uterine artery was associated with abnormal outcome in 69.23% and 38.41% was the mortality rate.

Notching of one of the uterine arteries had 71.42% abnormal perinatal outcome, 57.14% was the perinatal mortality.

B/L notch in uterine artery associated with 100% mortality.

This shows bilateral uterine artery abnormality to be more significant than unilateral abnormality in predicting abnormal outcome. The mortality being 100% in B/L uterine artery notch.

**Table- 3**

**Type of umbilical artery abnormality and associated perinatal outcome**

Umbilical Artery Doppler	outcome		Mortality	Morbidity
	Normal	abnormal		
Normal (54)	44	10	3	7
Abnormal (56)	10	46	18	28
High Resistance(41)	13	28	7	24
AEDF (11)	0	11	7	4
RDF (4)	0	4	4	0

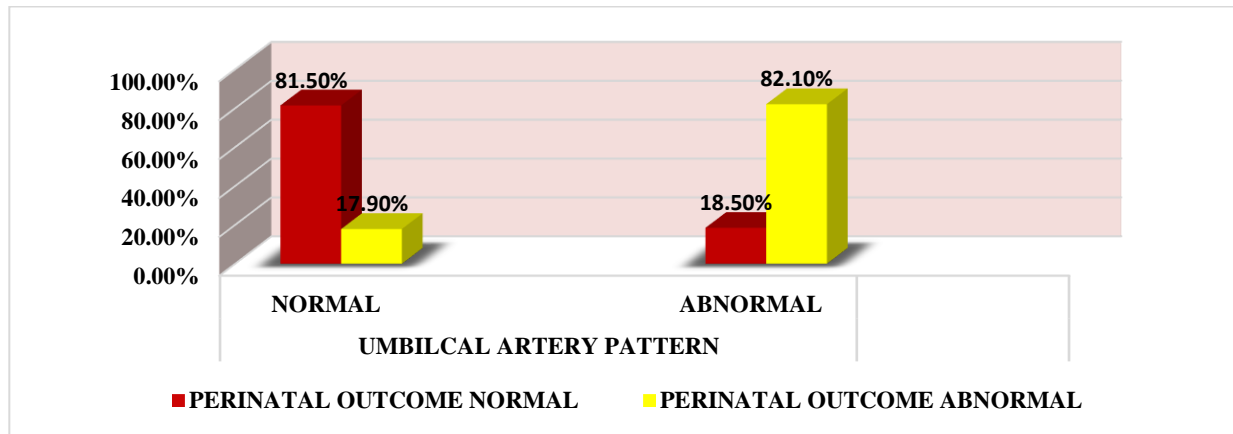
When umbilical artery flow was normal 81.48% had good perinatal outcome with only 18.52% having adverse perinatal outcome with 5.5% mortality and 12.96% morbidity.

Abnormal umbilical artery flow was associated with 82.14% having abnormal perinatal outcome, mortality being 57.14%

High resistance flow in umbilical artery showed 71.42 having poor perinatal outcome and 34.28% mortality and 37.14% morbidity.

AEDF in umbilical artery is associated with 90% mortality and RDF in umbilical artery associated with 100% mortality.

Figure-1



MCA doppler flow pattern was normal in 66.4% of cases, out of which 94.4% had good perinatal outcome and 39.3% had abnormal perinatal outcome.

Abnormal MCA doppler flow pattern was seen in 33.6% of cases, out of which 60.7% had abnormal perinatal outcome.

The sensitivity, specificity, positive predictive value and negative predictive value of middle cerebral artery doppler indices in predicting adverse perinatal outcome is 60.7%,94.4%, 91.9%, 69.9% respectively and the P value come out to be <0.05 which show the value are statistically significant.

Figure-2

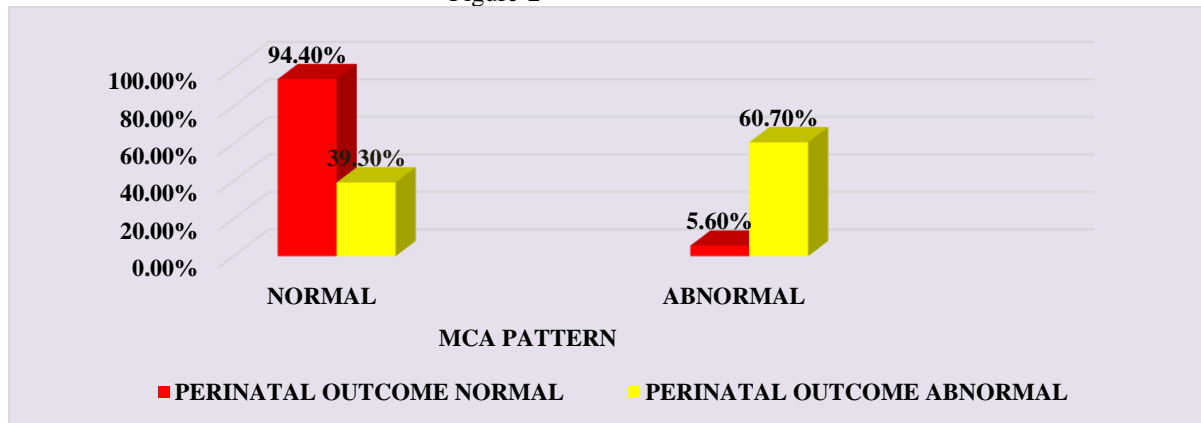


Table -4

MCA Pattern and Perinatal outcome

MCA pattern	No of cases	NND (neonatal death)	IUD (intrauterine death) & still birth	NICU admission	Uneventful	Eventful
Normal	73	7	1	14	22(30.1%)	51(69.9%)
Abnormal	37	12	2	20	34(91.9%)	3(8.1%)

Out of 37 abnormal MCA doppler pattern 34 went on to uneventful outcome out of which 20(58.8%) required NICU admission and the mortality is seen in 41.2%

The sensitivity, specificity, positive predictive value and negative predictive value of umbilical artery doppler indices in predicting adverse perinatal outcome is 82.1%,81.5%, 81.14%, 82.14% respectively and the P value come out to be <0.05 which show the value are statistically significant.

The sensitivity, specificity, positive predictive value and negative predictive value of uterine artery doppler indices in predicting adverse perinatal outcome is 46.4%,75.9%, 66%, 57.74% respectively and the P value come out to be P-0.014 which show the value are statistically significant

The sensitivity, specificity, positive predictive value and negative predictive value of CPR ratio in predicting adverse perinatal outcome is 85.7%%,96.3%, 96%,86.66% respectively and the P value come out to be <0.05 which show the value are statistically significant.

Figure-3

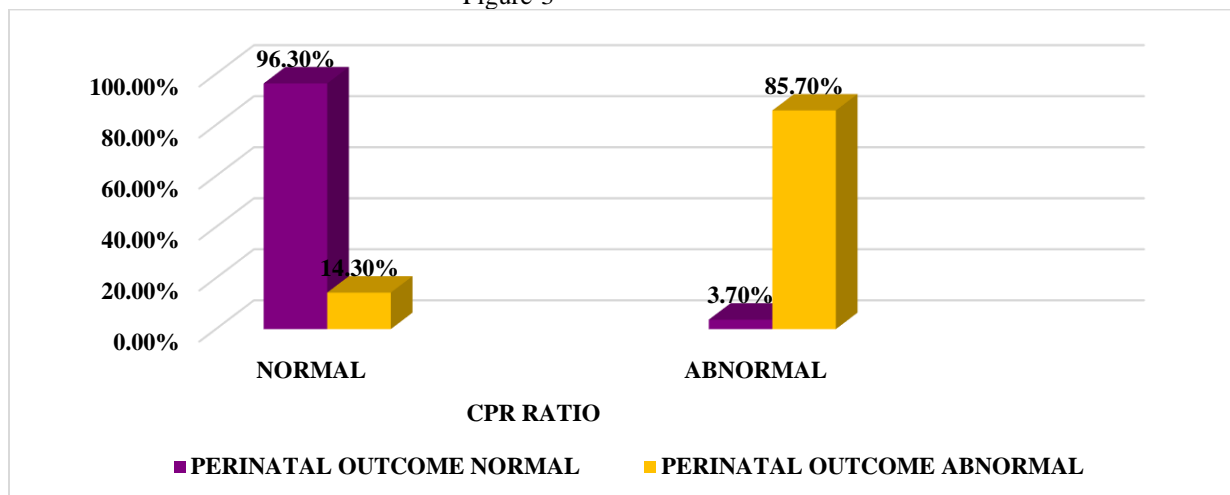


Table-5

CPR ration <1.08 and Perinatal outcome

CPR ratio	No of cases	NND (Neonatal death)	IUD (Intrauterine death and) & still birth	NICU admission	Uneventful	Eventful
Normal	60	3	0	5	8	52
Abnormal	50	14	4	20	48	2

Out of 50 abnormal CPR ration 48 went on to uneventful outcome out of which 20(50%) required NICU admission and the mortality is seen in 37.5%%of cases.

### Discussion:

#### Uterine artery Doppler study –

study conducted in third trimester high risk pregnant women between 28-41 weeks, other studies which are conducted in the third trimester are by **Lavanya Rai and Lekshmi<sup>1</sup>** S (28-37weeks) and **Polina Shwarzman et al<sup>2</sup>** (27-41weeks). Out of 110 cases of clinically suspected IUGR, abnormal uterine artery indices were seen in 39 cases among which uterine artery diastolic notch was in 9 cases. Incidence of abnormal fetal outcome (IUGR, IUFD and perinatal mortality) was higher in this group. various study suggests that the increased Doppler indices in uterine artery and persistence of diastolic notch after 26 weeks constitute an ominous sign and indicate the requirement for fetal monitoring.

In both these groups of high resistance and uterine artery diastolic notch, the incidence of caesarean section was significantly high. Out of 39 cases with abnormal uterine artery, 29cases (74.35%) had caesarean section and 20.5% patients delivered vaginally which is similar to study conducted by **Lavanya RA and S Leskhsmi<sup>1</sup>** in which 23% of the patients delivered vaginally and 77% had caesarean section.

According to the study by **M. Segata et al<sup>3</sup>**, vaginal delivery occurred in 68.3% of the cases (study constituted only of subjects with foetal growth restriction). In our study Vaginal delivery is 20.5% , reason may be that ,in their study they included the near term cases and included those with normal umbilical artery doppler, whereas in our study more no of cases went on to foetal distress and also there is increasing trend of caesarean section in high risk group and the most common indication for caesarean section was fetal distress which is similar to **M.Segata et al<sup>3</sup>**.

findings of **Ghosh et al<sup>4</sup>** where RI, PI, and notching were considered to be equally predictive of adverse outcomes.

We take take both notching and high PI as integrated system rather than comparing the individual abnormalities.

We found abnormal uterine artery doppler in 30%cases of the hypertensive patients excluding chronic HTN. **H Li et al<sup>27</sup>** reported 33.33% abnormality in pre-eclampsia cases. **Alexander Kofinas et al<sup>6</sup>** reported 63% abnormality in the cases with pre-eclampsia, in our study most of the uterine artery doppler were one at term while the study done by **Alexander Kofinas et a<sup>6</sup>** I was an opportunistic study done on patients referred to them.

Neonatal morbidity was 30.56% that required NICU admission as this was a high-risk group, it is higher than study done by **M. Segata et al<sup>3</sup>** observed a lower admission rate to NICU (9.7%) with perinatal death occurring in none. As they included IUGR cases at > 34weeks of gestation only.

The sensitivity of uterine artery Doppler indices to identifying the adverse fetal outcome is 46.4%, specificity 75.9%, positive predictive value of 66% negative predictive value 57.74%, diagnostic accuracy of 60% and P value

0.014 which shows statistical significance, Though statistically significant ,uterine artery doppler for predicting adverse perinatal outcome in our study is modest, which is similar to study done by **sarah G Obican et al<sup>7</sup>.J Maternal fetal Neonatal Med.2020 Oct48.**

Various authors have report different definition for prediction of adverse perinatal outcome,.In our study NICU admission and perinatal mortality (stillbirths and neonatal death) and intrauterine death are included as adverse perinatal outcome.

#### **Umbilical artery study -**

Out of 110 cases, abnormal umbilical artery Doppler indices were seen in 56 cases, Absent end diastolic flow was present in 11 cases, and 4 cases had reversed end diastolic flow. All patients showing reduced forward diastolic flow went on to SFD outcomes. 4 patients showing reversed diastolic flow went on as perinatal deaths accounting for 100% mortality and out of 11 cases with absent diastolic flow 7 cases (63.63%) went on to perinatal death. This confirms the finding of **Karsdorp et al<sup>8</sup>** which show reverse diastolic flow and absent diastolic flow better indicator of adverse perinatal outcome. Studies by **Bhatt CJ et al and Battaglia et al<sup>9</sup>** (50%) mortality was seen in pregnancies with AEDF and REDF, in our study mortality is (73.33%).

Out of 56 cases, 41cases had caesarean section (73.21%) with appearance of abnormality in the umbilical artery Doppler waveform. Most (37.5%) of caesarean section in abnormal UA group was done for absent diastolic flow velocity and reverse diastolic flow velocity.

**Seyam et al<sup>10</sup>** evaluated that foetuses who have abnormal PI of umbilical artery come to know that they were at increased risk of early delivery 68%, 22% of them admitted to NICU and 11% of them need PPV , whereas in our study neonatal admission were 50% , this difference may be due to better resuscitative facilities in their set up.

we obtained a better performance for all the parameters. One of the reasons for this could be the fact that while **Dhand et al. (2011)<sup>11</sup>** carried out their study as a case-control study, in the our study, we had only a prospective case series of high IUGR high risk-designated pregnancies.

Umbilical artery PI is relatively a more-specific than a sensitive criteria. In the present study the sensitivity of umbilical artery Doppler indices in identifying adverse foetal outcome in the present study was 82.1 % , with a specificity of 81.50 % , positive predictive value of 81.14% and a negative predictive value of 82.14% , diagnostic accuracy 81% and P value 0.0001 which shows statistically significant, which is similar to study result of **Khanduri S et al<sup>12</sup>.**

#### **Middle cerebral artery study-**

Out of 110 pregnant women with high-risk pregnancy, abnormal middle cerebral artery doppler indices were seen in 37 cases. Out 37cases 34 (91.89%) are having abnormal perinatal outcome. Out of 37 abnormal MCA doppler pattern 34went on to uneventful outcome out of which 58.8% required NICU admission and the mortality is seen in 41.2%

The sensitivity of middle cerebral artery indices in identifying adverse fetal outcome in the present study was 60.7%, specificity of 94 % , positive predictive value of 91.9%, negative predictive value of 69.9%, diagnostic accuracy 77% and P value 0.0001 which is statically significant. These values are in consonance with **Lakhkar et al<sup>13</sup>**

Various authors have reported diverse values in prediction of adverse perinatal outcome on the basis of MCA PI alone.

**MCA PI/ UMB PI Ratio (C/U) study-**

Out of 110 patients, abnormal C/U ratio was seen in 50 cases (45.45%), out of which 34 cases were delivered by caesarean section (64%). 48 went on to uneventful outcome of which 20(50%) required NICU admission and the mortality is seen in 37.5% of cases.

The sensitivity of C/U ratio in identifying adverse fetal outcome in the present study was 85.5%, specificity of 96.3% , positive predictive value of 96%, negative predictive value of 86.66%, diagnostic accuracy 90.90% and P value 0.0001 which is less than <0.05 which shows significant statistically, **Bano et al. (2010)<sup>14</sup>** study shows the MCA/UI PI ratio of 83.3% sensitive and 100% specific with a PPV, NPV and diagnostic accuracy of 100%, 94.3% and 95.6% The C/U ratio and is a better predictor of SGA fetuses and adverse perinatal outcome than the MCA PI or the UA PI used alone .

Among all indices Doppler C/U ratio was the best of all with sensitivity of 85.5%. In the present study, MCA PI/UA PI ratio with a gestational age specific cut off value 5<sup>th</sup> percentile had similar performance in prediction of adverse perinatal outcome.

**Conclusion:**

The age of our patients ranging from 18 to 38year of which 76.36% belong to age group 20-30year, 13.63% were above 30year and 10% belong to <20years. Out of 110 patients 48.18% of them were primigravida and 51.82% were multipara. It is seen that 32.72% had H/O hypertension on pregnancy which is the most common etiological factor of IUGR in our study , next group is no specific history and that is 22.72% and 14.54% had associated with anemia. 46.36% had amniotic fluid index between 6-10 that is demarcated as reduced amniotic fluid index.

abnormal uterine artery indices were seen in 39 cases among which uterine artery diastolic notch was in 9 cases. Incidence of abnormal fetal outcome (IUGR, IUFD and perinatal mortality) was found higher in this group. Various study found that increased Doppler indices in uterine artery with associated diastolic notch and persistence of diastolic notch after 26 weeks constitute an ominous sign and indicate the requirement for timely and intense foetal surveillance and intervention.

the incidence of caesarean section was significantly more in those who have diastolic notch and high resistance uterine artery flow and uterine artery, Out of 39 cases with abnormal uterine artery, 29cases (74.35%) had caesarean section and 20.5% patients delivered vaginally. Out of 39 abnormal uterine artery pattern 26 had abnormal perinatal outcome (66.66 %). We found abnormal uterine artery doppler in 30%cases of the hypertensive patients excluding chronic HTN.

Neonatal morbidity is significant as 30.56% of the neonate required NICU admission.

The sensitivity of uterine artery Doppler indices to identifying the adverse fetal outcome is 46.4%, specificity 75.9% , positive predictive value of 66% negative predictive value 57.74%, diagnostic accuracy of 60% and P value 0.014 which shows statistical significance. Though statistically significant predictive value of uterine artery doppler for adverse perinatal outcome is modest.

abnormal umbilical artery Doppler indices were seen in 56 cases, Absent end diastolic flow was present in 11 cases, and 4 cases had reversed end diastolic flow. All patients showing reduced forward diastolic flow went on to SFD outcomes. 4 patients showing reversed diastolic flow went on as perinatal deaths accounting for 100% mortality and out of 11 cases with absent diastolic flow 7 cases (63.63%) went on to perinatal death.



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Umbilical artery PI is relatively a more-specific. The sensitivity of umbilical artery Doppler indices in identifying adverse fetal outcome in the present study was 82.1 %, with a specificity of 81.50 %, positive predictive value of 81.14% and a negative predictive value of 82.14%, diagnostic accuracy 81% and P value 0.0001 .

Abnormal middle cerebral artery doppler indices were seen in 37 cases. Out 37 cases 34 (91.89%) are having abnormal perinatal outcome.

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The sensitivity of C/U ratio in identifying adverse fetal outcome in the present study was 85.5%, specificity of 96.3% %, positive predictive value of 96%, negative predictive value of 86.66%, diagnostic accuracy 90.90% and P value 0.0001.

Among all indices Doppler C/U ratio was the best of all with sensitivity of 85.5% and a diagnostic accuracy of 90.90% in predicting adverse perinatal outcome.

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