



**“TO ASSESS FETO-MATERNAL CIRCULATION BY DOPPLER STUDY IN WOMEN WITH THIRD TRIMESTER AND ITS CO RELATION WITH FETO-MATERNAL OUTCOMES.”**

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**ABSTRACT**

**INTRODUCTION:** Pre-eclampsia is a leading cause of maternal and perinatal mortality and morbidity throughout the world, accounting for 24% of all maternal deaths in India. 1,2 In developed countries, it accounts for 7-10% of perinatal mortality and 20% in developing countries. Early detection of preeclampsia may allow for vigilant antenatal surveillance and timely foetal delivery to avoid serious complications. The aim of the study was to determine and compare the diagnostic performance of Doppler sonography of fetal middle cerebral artery (MCA) and umbilical artery (UA) in prediction of adverse perinatal outcome in suspected intrauterine growth retardation (IUGR) and severe PE. **METHODOLOGY:** 100 pre-eclampsia patients were taken in study at Sir T. General Hospital, Bhavnagar from January 2021 to July 2022. The various measures of central tendencies and graphical representations were used to analyse the data. **RESULTS:** Majority of patients were in the age group of 26-30 years. Maximum incidence was seen with primigravida (65%). Out of all patients maximum patients delivered normally (67%). Patients delivered low birth weight babies were around 38%. Umbilical Artery Doppler parameters such as abnormal S/D ratio, Elevated Resistivity index, and elevated Pulsatility Index were found as (78.72%), (80.85%) and (87.23%) in Adverse Outcome event which is statistically significant compared to Good outcome ( $p < 0.0001$ ). Middle cerebral artery Doppler parameters such as abnormal S/D ratio, Elevated Resistivity index, and elevated Pulsatility Index are found as (25.53%), (76.59%) and (72.34%) in Adverse Outcome event which is statistically significant compared to Good outcome ( $p < 0.0001$ ). In addition, Cerebro Placental Ratio have found significantly high abnormality (89.36%) of neonates in adverse group. **CONCLUSION:** The Doppler technology is helpful in repetitive noninvasive haemodynamic monitoring of pregnancy. In an obstetric patient population with a high prevalence of complications like preeclampsia, the Doppler indices from the fetal circulation can reliably predict adverse perinatal outcomes. Thus the appropriate timing of delivery is to be made before these changes occur. However, the Doppler study of multiple vessels helps predict adverse outcomes, manage high-risk pregnancies complicated by preeclampsia.

**KEYWORDS:** Pre-eclampsia, MCA, Pulsatility Index, Resistivity index

**INTRODUCTION:**

Pre-eclampsia is a leading cause of maternal and perinatal mortality and morbidity throughout the world, accounting for 24% of all maternal deaths in India. 1,2 In developed countries, it accounts for 7-10% of perinatal mortality and 20% in developing countries. Early detection of preeclampsia may allow for vigilant antenatal surveillance and timely foetal delivery to avoid serious complications.

The **trophoblastic invasion** of the maternal decidua, myometrium, and blood vessels is required for human placentation. Cytotrophoblastic cells invade and partially replace the endothelium of the maternal spiral arteries, causing progressive vessel dilatation. This process begins as early as the tenth day after conception and continues throughout the pregnancy. 3,4 **Defective placentation** is thought to be the primary cause of pre-eclampsia and IUGR, both of which are major causes of perinatal mortality and morbidity worldwide. 5,6 Reduced uteroplacental perfusion can lead to foetal growth restriction, decreased amniotic fluid volume, and an inability to tolerate the in utero environment, ultimately leading to intrauterine death. The timely diagnosis of fetal compromise is very important so that delivery can be affected before fetus suffers irreversible damage and dies in utero.

The aim of the study was to determine and compare the diagnostic performance of Doppler sonography of fetal middle cerebral artery (MCA) and umbilical artery (UA) in prediction of adverse perinatal outcome in suspected intrauterine growth retardation (IUGR) and severe PE.

**OBJECTIVES:**

- To assess third trimester doppler study in women with preeclampsia and their feto maternal outcome.
- To estimate S/D ratio, RI, PI and ratio of MCA PI:UA PI of

umbilical artery and fetal middle cerebral artery in preeclampsia.

- To correlate fetal outcome to doppler umbilical and middle cerebral artery waveforms in severe preeclampsia and IUGR.

**MATERIAL & METHODS:**

100 pre-eclampsia patients were taken in study at Sir T. General Hospital, Bhavnagar from January 2021 to July 2022.

**Inclusion Criteria:**

- Pregnant women of 34-40 weeks with
- Gestational Hypertension - BP  $\geq$  140/90mm Hg
- Proteinuria : ++ by dipstick method

**Exclusion Criteria:**

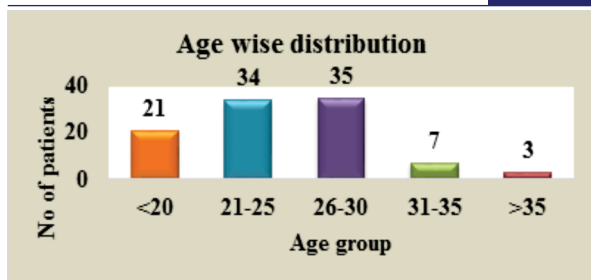
- Pregnant women of <20 weeks with hypertension and proteinuria.
- Multiple pregnancy
- Patients with k/c/o DM, Epilepsy, Asthma

**RESULTS:**

**Table 1: Age Wise Distribution**

Age (yrs)	No of patients (n=100)
<20	21 (21%)
21-25	34 (34%)
26-30	35 (35%)
31-35	7 (7%)
>35	3 (3%)
Total	100 (100%)
Mean Age (yrs)	25.17 $\pm$ 4.41

In the present study, it is found that 35 (35%) of patients are higher in 26-30 years age group followed by 34 (34%) of patients in 21-25 years age group.



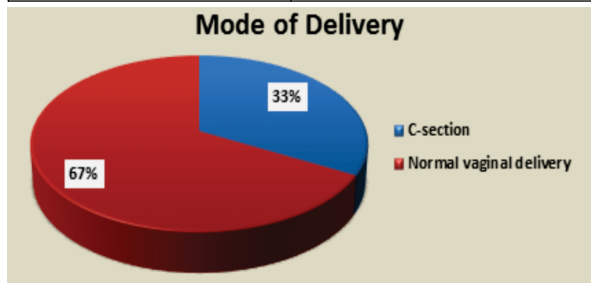
**Table 2: Parity Wise Distribution**

Parity	No of patients (n=100)
Primigravida	65 (65%)
Multigravida	35 (35%)
Total	100 (100%)

In the present study, it is found that primi parity is found in 65 (65%) mother while, multi parity in 35 (35%) mother.

**Table 3: Mode Of Delivery Wise Distribution**

Mode of delivery	No of patients (n=100)
C-section	33 (33%)
Normal vaginal delivery	67 (67%)
Total	100 (100%)



In the present study, maternal mode of delivery has found that Normal vaginal delivery 67 (67%) patients while LSCS done in 33 (33%) patients.

**Table 4: Birth Weight Of Neonates Wise Distribution**

Weight (kg)	No of patients (n=100)
<2.5 kg	38 (38%)
≥ 2.5-3.5 kg	62 (62%)
Total	100 (100%)
Mean weight (kg)	2.47 ± 0.51

In the present study, low birth weight is found that in 38 (38%) patients then normal birth weight in 62 (62%) patients with mean birth weight was 2.47 ± 0.51 kg.

**Table 5: Adverse Outcome Of Neonates**

	Number of patients (n=100)
Neonatal Outcome	100 (100%)
• Stillbirth	7 (7%)
• Live birth	93 (93%)
Apgar Score (at 5 min)	93 (93%)
• <7	34 (36.55%)
• >7	59 (63.44%)
NICU Admission	41 (41%)
Neonatal Death	11 (11%)

In the present study, it is found that stillbirth in 7 (7%) patients, Apgar score <7 in 34 (36.55%) patients, NICU Admission in 41 (41%) patients, and Neonatal Death 11 (11%) in neonates.

**Table 6: Umbilical Artery Doppler Wise Distribution**

Umbilical Artery	Adverse Outcome (n=47)	Good outcome (n=53)	Sensitivity (%)	Specificity (%)	P value
S/D ratio <3 ≥3	10 (21.27%) 37 (78.72%)	35 (66.03%) 18 (33.96%)	74.47 %	73.58 %	<0.001

Resistivity index Elevated	38 (80.85%)	15 (28.30%)	74.9%	79.2%	<0.001
Normal	9 (19.14%)	38 (71.69%)			
Pulsatility Index Elevated	41 (87.23%)	22 (41.50%)	82.2%	71.2%	<0.001
Normal	6 (12.76%)	31 (58.49%)			

In the present study, due to Umbilical Artery Doppler parameters such as abnormal S/D ratio Elevated Resistivity index, and elevated Pulsatility Index are found as 37 (78.72%), 38 (80.85%), and 41 (87.23%) in Adverse Outcome event which is statistically significant compared to Good outcome. (p<0.000).

**Table 7: Middle Cerebral Artery Wise Distribution**

Middle Cerebral Artery	Adverse Outcome (n=47)	Good outcome (n=53)	Sensitivity (%)	Specificity (%)	P value
S/D ratio Normal	35 (74.46%)	49 (92.45%)	86.2 %	64.9%	0.0143
Abnormal	12 (25.53%)	4 (7.54%)			
Resistivity index Elevated	36 (76.59%)	18 (33.96%)	69.4 %	66.0%	<0.001
Normal	11 (23.40%)	35 (66.03%)			
Pulsatility Index Elevated	34 (72.34%)	20 (37.73%)	77.2 %	64.3%	<0.001
Normal	13 (27.65%)	33 (62.26%)			
CPR Normal	5 (10.63%)	38 (71.69%)	90%	64.74 %	<0.001
Abnormal	42 (89.36%)	15 (28.30%)			

In the present study, due to middle cerebral artery Doppler parameters such as abnormal S/D ratio, Elevated Resistivity index, and elevated Pulsatility Index are found as 12 (25.53%), 36 (76.59%) and 34 (72.34%) in Adverse Outcome event which is statistically significant compared to Good outcome. (p<0.0001)

**DISCUSSION:**

Preeclampsia is strongly related to development and function of uteroplacental and fetoplacental circulations. This results in improper blood flow in uterine and umbilical arteries. Doppler assessment of the fetal cerebral and umbilicoplacental circulations can detect fetal blood flow redistribution during hypoxia and quantify the degree of this redistribution. Although the brain-sparing effect attempts to compensate for the reduced oxygen delivery to the fetal brain, it has recently become clear that this phenomenon cannot always prevent the development of brain lesion.

**Age Wise Distribution**

Authors	Mean Age (yrs)
Padmini CP et al7	23.73
Gaikwad PR et al8	26.91
Smitha K et al9	23.41
Konwar R et al10	26.61
Present study	25.17

In the present study, it is found that (35%) of patients are higher in 26-30 years age group followed by (34%) of patients in 21-25 years age group with mean age of 25.17 ± 4.41 years which are closely to mean age comparable to other study described in above table.<sup>67-70</sup>

**Parity Wise Distribution**

Parity	Present study	Kshirsagar SC et al11	Lakshmi VAA et al12	Gaikwad PR et al8
Primigravida	(65%)	54%	69%	54.72%
Multigravida	(35%)	46%	31%	45.28%

In the present study, it is found that primi parity is found in (65%) mother while, multi parity in (35%) mother which are comparable as other study such as **Kshirsagar SC et al<sup>11</sup>**,

Lakshmi VAA et al<sup>12</sup>, and Gaikwad PR et al<sup>8</sup> with higher number of primigravida patients 54%, 69%, and 54.72% respectively. Pre-eclampsia has been defined as a disease of first pregnancies. The association between primiparity and pre-eclampsia is so widely accepted that it is at the core of several pathophysiological theories. For example, it has been proposed that pre-eclampsia is the consequence of a maternal immune reaction against paternal antigens expressed in the placenta and that this reaction might result in defective trophoblast invasion and subsequent placental dysfunction. The lower risk of pre-eclampsia among multiparous women has been attributed to desensitisation after exposure to paternal antigens in the placenta during previous pregnancies. The lower risk has also been attributed to smoother trophoblastic invasion after modification of maternal spiral arteries during the first pregnancy.

**Mode Of Delivery Wise Distribution**

Mode of delivery	Present study	Kshirsagar SC et al <sup>11</sup>	Konwar R et al <sup>10</sup>	Smitha K et al <sup>9</sup>
C-section	33%	48%	30%	27%
Normal vaginal delivery	67%	52%	70%	63%

In the present study, maternal mode of delivery has found that LSCS done in (33%) patients are comparable as other study such as Kshirsagar SC et al<sup>11</sup>, Konwar R et al<sup>10</sup> and Smitha K et al<sup>9</sup> with C-section 48%, 30% and 27% respectively.

**Birth Weight Of Neonates Wise Distribution**

Weight (kg)	Present study	Kshirsagar SC et al <sup>11</sup>	Gaikwad PR et al <sup>8</sup>
LBW	38%	48%	34.91%
NBW	62%	52%	65.09 %

In the present study, low birth weight is found that in (38%) patients with mean birth weight is 2.47 ± 0.51 kg, which are comparable as other study such as Kshirsagar SC et al<sup>11</sup> and Gaikwad PR et al<sup>8</sup> with LBW 48% and 34.91% respectively. The predominant etiologic theory of preeclampsia is that reduced uteroplacental perfusion is the unique pathogenic process in the development of preeclampsia. Decreased uteroplacental blood flow would result in lower birth weight

**Adverse Outcome Of Neonates**

Adverse outcome	Present study	Konwar R et al <sup>10</sup>	Gaikwad PR et al <sup>8</sup>	Padmini CP et al <sup>7</sup>
Stillbirth	7%	14.7%	-	2.5%
Low Apgar Score	36.55%	32.3%	45.94%	16.25%
NICU Admission	41%	58.8%	40.54%	7.5%
Neonatal Death	11%	5.9%	8.10%	5%
LBW	38%	55.9%	-	-
LSCS	33%	44.1%	32.43%	-

In the present study, it is found that Adverse outcome defined as stillbirth in (7%) patients, Apgar score <7 in (36.55%) patients, NICU Admission in (52%) patients, LBW 38% neonates, and LSCS 33% neonates and Neonatal Death (11%) in neonates which is comparable to other study such as Konwar R et al<sup>10</sup>, Gaikwad PR et al<sup>8</sup>, and Padmini CP et al<sup>7</sup> in detail described in table above.

**Doppler Indices Distribution**

	Present study		Konwar R et al <sup>10</sup>		Lakshmi VAA et al <sup>12</sup>	
	Sensitivity	Specificity	Sensitivity	Specificity	Sensitivity	Specificity
UmbA S/D ratio	74.47%	73.58%	75.8%	41.2%	83.6%	74.4%
UmbA RI	74.9%	79.2%	60.6%	70.6%	84.9%	72.3%
UmbA PI	82.2%	71.2%	60.6%	58.8%	86.7%	63.8%
MCA S/D ratio	86.2%	64.9%	81.8%	64.7%	83%	70.2%
MCA RI	69.4%	66.0%	66.7%	70.6%	67.9%	76.5%
MCA PI	77.2%	64.3%	66.7%	82.3%	62.2%	78.7%
CPR	90%	64.74%	84.8%	76.5%	90%	86.0%

In the present study, due to Umbilical Artery Doppler parameters such as abnormal S/D ratio Elevated Resistivity index, and elevated Pulsatility Index are found as (78.72%), (80.85%), and (87.23%) in Adverse Outcome event which is statistically significant compared to Good outcome. (p<0.0001).

In the present study, due to middle cerebral artery Doppler parameters such as abnormal S/D ratio, Elevated Resistivity index, and elevated Pulsatility Index are found as (25.53%), (76.59%) and (72.34%) in Adverse Outcome event which is statistically significant compared to Good outcome. (p<0.0001).

In addition, Cerebro Placental Ratio have found significantly high abnormality (89.36%) of neonates in adverse group compared to (28.30%) neonates good outcome with sensitivity and specificity are 60% and 44.74% respectively.

Moreover, the early Diastolic notch of UtA and MCA PI was most specific in diagnosing adverse perinatal outcomes. The sensitivity of the UtA Doppler study to detect adverse perinatal effects was 72.17% when four Doppler parameters were considered.

Among the Umbilical artery Doppler parameters, the S/D ratio included the highest sensitivity of 75.8% for predicting adverse outcomes.

In the study by Kshirsagar SC et al<sup>11</sup> have found that uterine artery presence of notch and umbilical artery S/D Ratio has got maximum sensitivity and negative predictive value while umbilical artery and middle cerebral artery resistance index has got maximum specificity and positive predictive value for adverse outcome.

In addition, the cerebroplacental index has the highest specificity and positive predictive value 98.55% and 94.44% respectively in predicting adverse perinatal outcome, compared to that of Umbilical artery Pulsatility index (92.75% and 68.75%) and MCA Pulsatility index (85.51 and 44.44%).

**CONCLUSION:**

The Doppler technology is helpful in repetitive noninvasive haemodynamic monitoring of pregnancy. In an obstetric patient population with a high prevalence of complications like preeclampsia, the Doppler indices from the fetal circulation can reliably predict adverse perinatal outcomes. The cerebroplacental ratio is a valuable predictor of adverse perinatal outcomes. Thus the appropriate timing of delivery is to be made before these changes occur. However, the Doppler study of multiple vessels helps to predict adverse outcomes & manage high-risk pregnancies complicated by preeclampsia, prevent near miss and also prevents maternal mortality by preeclampsia which is 2<sup>nd</sup> most common reason of maternal mortality in pregnancy.

**REFERENCE:**

1. WHO. International Collaborative study of Hypertensive disorders of pregnancy. Geographic variation in the incidence of Hypertension in pregnancy. Am J Obstet Gynecol. 1988;158:80-3.
2. Confidential Enquiry into maternal deaths: Why mothers die? 2000-2002. The sixth Report of the confidential Enquiries into maternal deaths in UK. London: RCOG Press;2004.
3. Pijnenborg R, Dixon G, Robertson WR, Brosens F. Trophoblastic invasion of human decidua from 8-18 wks of pregnancy. Placenta. 1980;1:3-19.
4. Kam EPY, Gardner L, Loke YW, King A. The role of trophoblast in physiological change in decidual spiral arteries. Human Reprod. 1999;14:2131-8.
5. Brosens IA. Morphological changes in the uteroplacental bed in pregnancy Hypertension. Clin Obstet Gynecol. 1977;4:573-93.
6. Kohnen G. Villous development and the pathogenesis of IUGR in intrauterine growth restriction. Br J Obstet Gynecol. 1990;99:342-8.
7. Porcelot L. Applications cliniques de l'examen Doppler transcutané In: Perommeau P ed. Velocimetric ultrasonoic Doppler. Paris: INSERM;1974:213-40.
8. Gaikwad PR, Gandhewar MR, Rose N, Suryakar V. Significance of obstetric doppler studies in prediction of perinatal outcome in pregnancy induced hypertension. Int J Reprod Contracept Obstet Gynecol 2017;6:2354-60.

9. Smitha K, Sowmya K, Malathi T. Study of Doppler waveforms in pregnancy induced hypertension and its correlation with perinatal outcome. *Int J Reprod Contracept Obstet Gynecol* 2014;3:428-33.
10. Konwar R, Basumatari B, Dutta M, Mahanta Sr P, Saikia A, Rashmi UK. Role of Doppler Waveforms in Pregnancy-Induced Hypertension and Its Correlation With Perinatal Outcome. *Cureus*. 2021 Oct 19;13(10).
11. Kshirsagar SC, Shirodkar SS, Yadav SJ, Zile UM. Role of Doppler Indices in prediction of perinatal outcome in preeclampsia. *Int J Reprod Contracept Obstet Gynecol* 2016;5:3390-7.
12. Lakshmi VAA, Indira K, Rao PCK, Neeraja M. Role of Doppler in PIH and IUGR. *Int J Res Health Sci [Internet]*. 2015;3(1):191-8.