

**Full length Research Paper**

# Doppler Study of Foetal Middle Cerebral Artery and Umbilical Artery in Prediction of Neonatal outcome in Preeclampsia

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**Abstract**

Doppler measurement of umbilical and middle cerebral artery pulsatility index may play a role in the assessment and monitoring for fetal oxygenation in pregnancy associated with preeclampsia. Obstetrical decision might improve and prevent intrauterine death because hypoxic cerebral damage may begin before labor and intrapartum asphyxia is probably more damaging when superimposed on underlying hypoxia. Doppler assessment may lead to intervention that reduces the risk of fetal brain damage. The aim of this study is to evaluate the role of Doppler flow velocimetry of middle cerebral artery and umbilical artery in prediction of neonatal outcome in preeclampsia. This study was performed on 100 patients diagnosed with preeclampsia with singleton pregnant women in the department of obstetrics and gynecology, Sinbelawein General Hospital. All patients are subjected to full history taking, general examination, abdominal examination, Obstetric Ultrasound, Doppler study of umbilical artery and middle cerebral artery every 2 weeks. There is a strong correlation between mode of delivery and poor neonatal outcome as 13 cases among 14 patients have poor outcome and delivered by CS and only one case was delivered by NVD. Fetal birth weight ranges from 1250 to 3750gm, (86%) has good outcome, 14 patients have poor neonatal outcome presented by low Apgar score less than 7 at 5 minutes and there is no fetal deaths among 100 women included. The best cutoff value of UA RI as a predictor for poor neonatal outcome was 0.67. Area under the curve was significantly large (AUC = 0.74) (95% CI = 0.35-0.85,  $p = 0.001$ ). The use of Doppler ultrasound is not new in obstetric practice. It produces an immense amount of hemodynamic information from a circulation. Doppler US offers a unique noninvasive technology for investigating the fetal circulatory system. There is ample evidence associating abnormal Doppler findings with complications of pregnancy and an adverse prenatal outcome.

**Keywords:** Ultrasound-Preeclampsia-Doppler-prenatal outcome.

**Introduction**

Preeclampsia is the first cause of maternal morbidity and mortality, intrauterine growth retardation (IUGR), and fetal prematurity (Abdel Razik, 2016). Preeclampsia affects 5-10% of pregnancies and is clinically manifested after 20 weeks of gestation. Fetal hypoxemia caused by preeclampsia can lead to ischemic encephalopathy, growth retardation, and various sequelae of premature birth. Abnormal trophoblastic invasion of uterine vessels is a major cause of hypertension associated with preeclampsia syndrome. In fact, studies have shown that the degree of incomplete trophoblastic invasion of the spiral arteries is directly correlated with the severity of subsequent maternal hypertension. This is because the placental hypo perfusion resulting from the incomplete invasion leads by an unclear pathway to the release of systemic vasoactive compounds that cause an exaggerated inflammatory response, vasoconstriction, endothelial damage, capillary leak, hypercoagulability, and platelet dysfunction, all of which contribute to various clinical features of the disease and affect fetal oxygenation that leads to fetal hypoxemia (Abuhamad, 2008)

This hypoxemia is associated with increased impedance to flow in the umbilical artery and decreased impedance in the fetal middle cerebral artery (Berks D 2015). Consequently, Doppler measurement of umbilical and middle cerebral artery pulsatility index may play a role in the assessment and monitoring for fetal oxygenation in pregnancy associated with preeclampsia (Duley, 2010). Obstetrical decision might improve and prevent intrauterine death because hypoxic cerebral damage may begin before labor and intrapartum asphyxia is probably more damaging when superimposed on underlying hypoxia. Doppler assessment may lead to intervention that reduces the risk of fetal brain damage (Harmon, 2015).

The aim of this study is to evaluate the role of Doppler flow velocimetry of middle cerebral artery and umbilical artery in prediction of neonatal outcome in preeclampsia.

**Materials and Methods****Study area and Population**

This study was performed on 100 patients diagnosed with preeclampsia with singleton pregnant women in the department of obstetrics and gynecology, Sinbelawein General Hospital. All patients are subjected to full history taking, general examination, abdominal examination, Obstetric Ultrasound, Doppler study of umbilical artery and middle cerebral artery every 2 weeks.

Gestational age ranging from 28-36 weeks. Statistical analysis was performed by version 18 SPSS software; student's t test, Chi square and logistic regression analysis were used in the study. Confidence interval was 95% and P value <0.05 was significant.

Data Analysis

Data were analyzed using Statistical Program for Social Science (SPSS) version 20.0. Quantitative data were expressed as mean± standard deviation (SD). Qualitative data were expressed as frequency and percentage. The following tests were done:

- Independent-samples t-test of significance was used when comparing between two means.
- Chi-square ( $X^2$ ) test of significance was used in order to compare proportions between two qualitative parameters.
- Pearson's correlation coefficient (r) test was used for correlating data.
- Probability (P-value)
  - P-value  $\leq 0.05$  was considered significant.
  - P-value  $\leq 0.001$  was considered as highly significant.
  - P-value  $> 0.05$  was considered insignificant.

Results

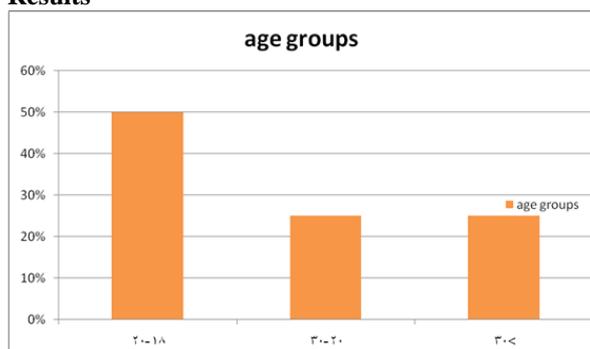


Fig 1: Bar chart for different age groups in the studied group

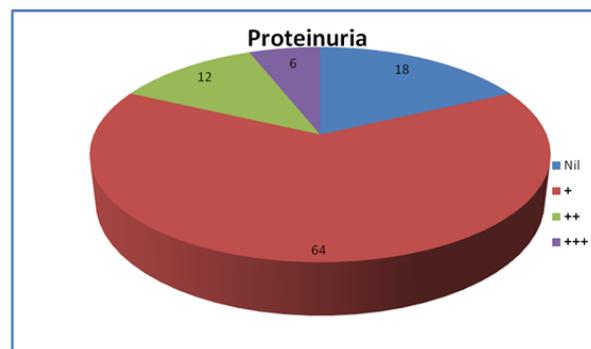


Fig 2: Pie chart for proteinurea in the studied group

Table 1: Relation between mode of termination and outcome in the studied group

Variable	Poor outcome N (14)	Good outcome N (86)	$\chi^2$	p-value
<b>Mode of termination</b>				
Vaginal	1	20	1.2	0.2
Cesarean section	13	66		

Table 2: Relation between protinurea and outcome in the studied group

Variable	Poor outcome N (14)	Good outcome N (86)	$\chi^2$	p-value
<b>Proteinuria</b>				
Nil	0	18	14.2	
+	3	61		
++	5	7		
+++	6	0		<b>0.002*</b>

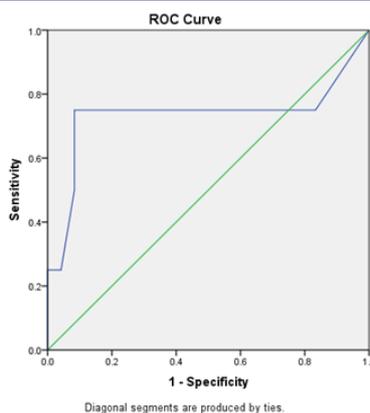


Fig 3: ROC curve for umbilical artery RI in detection of poor

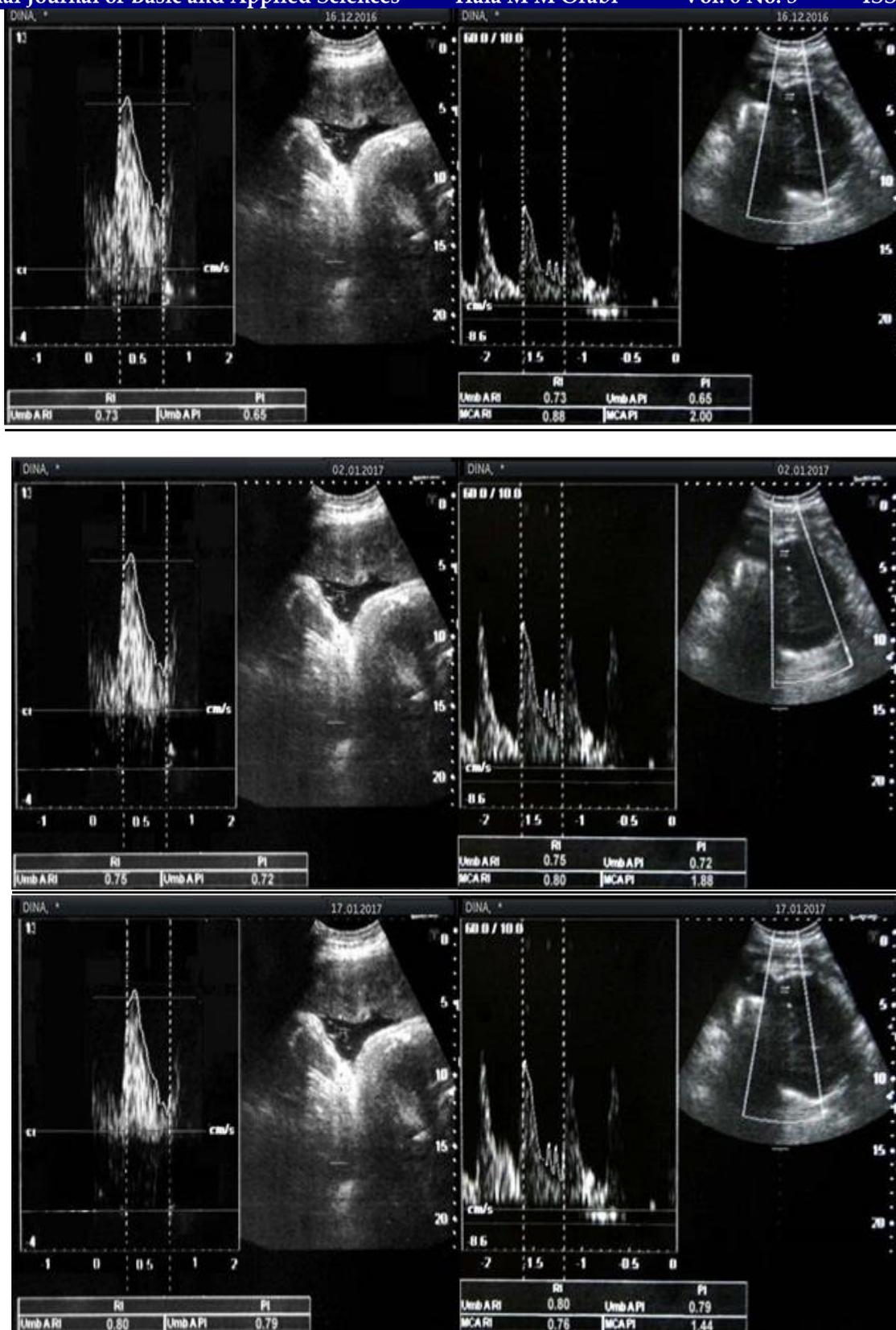


Fig 4: Serial Doppler US For Preeclamptic patient at 32 , 34 , 36 weeks of gestation

**Discussion**

Hypertensive disorders are the commonest medical disorder in pregnancy. It is a major cause of perinatal morbidity and mortality worldwide, with reported incidence of 5-10% (Mari G,1992). Doppler Velocimetry of Umbilical artery (UmA) and Middle cerebral artery (MCA) can detect fetal compromise much before than other antepartum test. Doppler ultrasound is used as a part of clinical protocol in surveillance of high risk pregnancies. It gives direct information of fetoplacental circulation and identifies placental circulatory failure. The advantage of Doppler ultrasound is that the technique is fast, reproducible and can be performed on a daily basis (Ness RB et al., 2006). This study consisted of 100 pregnant women in fertility age, parity

ranges from 0 to 5 and gestational age ranges from 32 to 36 weeks with average body built. Poon et al. (2009) observed that primiparity was almost twice as common in preeclampsia groups compared with randomly selected controls. In the present study there is a strong correlation between mode of delivery and neonatal outcome as (79%) had born C.S, 13% had poor fetal outcome, 66% had good outcome and 21% had born by vaginal delivery 1% had poor fetal outcome and 20 % had good fetal outcome . Another authors found that more number of cesarean in cases predicted to have adverse neonatal outcome (40%) than controls (29%). In Umatata general hospital found that the prevalence of LSCS among preeclampsia patients was (30.2%) although the global occurrence of cesarean section reaches 82 % in preeclampsia. In the present study proteinuria is (+1) in (64%) of cases, (+2) in (12%) of them had bad neonatal outcome and (+3) of cases had bad neonatal outcome . During 1976, scientists first highlighted the association between proteinuria and adverse neonatal outcome as he found increased excretion of protein in women with preeclampsia is associated with adverse neonatal outcome. In present study fetal birth weight ranges from 1250 to 3750gm, (86%) of cases has good fetal outcome, 14 patients have poor neonatal outcome presented by low Apgar score less than 7 at 5 minutes, there is no fetal deaths among 100 women included and (11%) of fetal outcome need NICU admission. In this study, Receiver Operator Characteristic (ROC) curve was constructed to estimate the association between umbilical artery RI and PI and poor outcome. The best cutoff value of UA RI as a predictor for poor neonatal outcome was 0.67. Area under the curve was significantly large. The best cutoff value of UA PI as a predictor for poor neonatal outcome. Area under the curve was significantly larger. The results obtained from this study showed association between high umbilical resistance and pulsatility indices and poor neonatal outcome, this results go with study done by Salem et al (2015), who found that abnormal umbilical RI value increased in 62.5 % of cases and umbilical PI value is increased in 93% of cases which showed adverse neonatal outcome. Also in Vadhera et al. (2014) abnormal blood flow patterns in fetal circulation detected by high doppler indices of the umbilical artery may indicate poor fetal

### Conclusion

Early detection of fetal compromise in utero by Doppler velocimetry findings in umbilical artery and middle cerebral artery for favourable perinatal outcome and fetus may be delivered before the occurrence of irreversible change. Color Doppler has an important role in antepartum fetal surveillance in preeclampsia which can detect fetal compromise at an early stage.

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