

Role of colour Doppler indices in diagnosis of intrauterine growth retardation in preeclampsia

¹Dr Anuja Sagamkunti, Assistant Professor, Dept of OBG, RIMS, Raichur.

²Dr Savita Konin, Professor, Dept of OBG, MRMC, Kalaburagi.

³Dr Asharani Kanaki, Assistant professor, Dept of OBG, MRMC, Kalaburagi.

Corresponding Author: Dr Anuja Sagamkunti, Assistant Professor, Dept of OBG, RIMS, Raichur.

How to citation this article: Dr Anuja Sagamkunti, Dr Savita Konin, Dr Asharani Kanaki, “Role of colour Doppler indices in diagnosis of intrauterine growth retardation in preeclampsia”, IJMACR- March - 2024, Volume – 7, Issue - 2, P. No. 117 – 123.

Open Access Article: © 2024, Dr Anuja Sagamkunti, et al. This is an open access journal and article distributed under the terms of the creative common’s attribution license (<http://creativecommons.org/licenses/by/4.0>). Which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

Type of Publication: Original Research Article

Conflicts of Interest: Nil

Abstract

Objectives: To evaluate incidence of Intrauterine growth retardation in Preeclampsia.

Methods: Hundred patients diagnosed with preeclampsia with gestational age between 31-41 weeks were studied and subjected to colour doppler ultrasonography. Uterine, umbilical and fetal middle cerebral arteries were studied. S/D ratio of > 3 , RI > 0.7 , AEDV and REDV in umbilical artery; RI < 0.7 , PI < 1.3 in middle cerebral artery were considered abnormal.

Results

- 71 cases (71%) had early diastolic notch on uterine artery Doppler.
- 60 cases (60%) had uteroplacental insufficiency on uterine artery Doppler, among which in 47 cases (78.3%) IUGR was detected.
- 61 cases (61%) had abnormal umbilical artery diastolic flow, among which in 58 cases (95.08%) IUGR was detected.

- 18 cases (18%) had brain sparing effect in middle cerebra artery in, among which IUGR was detected in all the cases.
- Out of 100 cases studied, 71(71%) showed positive Doppler indices in any of the three vessels studied. The remaining 29(29%) cases showed normal Doppler indices in all the three vessels studied.
- Babies of 54 cases (74.05%) with abnormal Doppler indices had NICU stay whereas 17 babies (23.09%) of the cases with abnormal Doppler indices did not have NICU stay.
- Among abnormal cases, 54 babies (76.05%) had APGAR score < 7 .

Conclusion: Doppler velocimetry is a primary tool for fetamaternal surveillance and indispensable for the management of pregnancy induced hypertension patients.

Keywords: Preeclampsia, Colour Doppler Ultrasonography, IUGR

Introduction

Pregnancy induced hypertension has been a recognized pathological entity since the time of Hippocrates and ancient Greeks¹. Hypertensive disorders in pregnancy is one of the major causes of maternal and perinatal mortality and morbidity. It is one of the commonest medical disorders diagnosed by obstetricians in clinical practice². It is said that pregnancy induced hypertension (PIH) contributes to the death of a woman every three minutes worldwide³. Preeclampsia is characterized by an imbalance between prostacycline and thromboxane production⁴, as well as failure of the second wave trophoblastic invasion of the endometrial-myometrial vasculature. The result is abnormal uteroplacental blood flow, and this has led to the idea of using Doppler in the evaluation and management of PIH patients.

Doppler ultrasound evaluation of the mother and fetus with the study of blood flow indices provides non-invasive assessment to study uteroplacental circulation and fetoplacental circulation and hemodynamic changes and adaptation of the fetal organs in response to hypoxemia; with this, the degree of placental dysfunction can be studied to know the severity of the disease. Doppler is useful in selecting the patients for induction and trial of labor, also helps in making decisions when to intervene without increasing fetal risk. This in effect contributes to lowering maternal morbidity and also neonatal morbidity and lowers the incidence of caesarean sections and admission to NICU care, and incidence of prematurity. Among high risk patients, several studies suggested a significant decrease in neonatal morbidity and mortality when Doppler evaluation was a part of fetal surveillance⁵.

Materials and Method

The study was conducted on hundred patients with clinically diagnosed preeclampsia, who were referred to the Department of Obstetrics and Gynaecology, Basaveshwar Teaching & General Hospital and Sangameshwar Teaching and General Hospital attached to Mahadevappa Rampure Medical College, Kalburgi during the period from November 2014 to July 2016.

Inclusion criteria

1. The gestational age of patients between 31-41 weeks.
2. Singleton pregnancy.
3. Known case of preeclampsia.

Exclusion criteria

1. Congenital malformation of foetus.
2. Multifetal pregnancy.
3. Any associated complications like medical disorders.

Objective of the study is to evaluate incidence of Intrauterine growth retardation in preeclampsia.

In all the cases, detailed history of the patient was taken including the name, age, education, religion, socioeconomic status and presenting complaints. Menstrual history, past history, medical and surgical history, family history – diabetes and hypertension were noted. Per abdomen examination was done for the fundal height, lie, presentation and position of the foetus. Fetal heart rate was recorded by sound Doppler. Also, local examination including vulva, vagina, urethra was done. Per speculum examination was done for cervix and vagina and any leak/bleeding per vaginum. Detailed per vaginal examination was done for dilatation, effacement, position of cervix, station of presenting part and adequacy of pelvis.

All patients with preeclampsia with inclusion criteria will be subjected to Doppler examination. Doppler wave

forms will be obtained for umbilical, uterine and middle cerebral arteries and various indices will be calculated viz. Pulsability Index (PI), Resistance Index (RI), S/D ratio-ratio of peak systolic and diastolic flow.

The first scan was performed in each case, as soon as the patient was registered in order to avoid any influence of treatment on Doppler sonogram. The gestational age was confirmed by menstrual history and ultrasound examination and was followed by color Doppler examination. Consent was taken from the patient or the guardian.

Procedure

The patient was explained about the noninvasive/atraumatic nature of the procedure. Synthetic ultra gel was applied liberally over the abdomen to get a good acoustic coupling. The instruments used were Hitachi EUB 5500, Hitachi EUB 7000, Philips Envisor HD C-1.3 Color Doppler Ultrasound machine with a convex transducer of 2-5 MHz frequency. Doppler wave form was obtained after localising the vessels by B-mode real time scanner. Pulsed Doppler was used to get the Doppler signals after localising the vessels. The maximum Doppler shift frequencies were obtained and various ratios were calculated from each vessel. Doppler examination was done when fetus was in apneic state to avoid the influence of fetal respiration on Doppler signals.

Identification of various arteries and their criteria

1. Uterine artery: Colour Doppler facilitates identification of the uterine artery substantially. The uterine signal was obtained per abdomen by pointing the probe in the iliac fossa towards the lower pericervical area. In the colour mode, the uterine artery is seen to cross the external iliac artery, just after its origin from the internal iliac artery and this point

was taken as the sampling point. S/D > 2.6, RI > 0.58 and persistent early diastolic notch is considered abnormal.

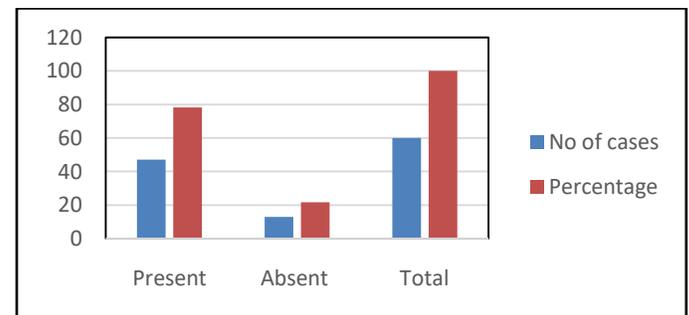
- 2. Umbilical Artery:** Flow velocity waveforms from umbilical artery can be easily obtained, for this color flow is not usually needed. Doppler signals can be acquired from different points in cord, usually from midportion of cord. S/D ratio of umbilical artery > 3, RI > 0.7, presence of absent end diastolic velocity (AEDV) and reversed end diastolic velocity (REDV) were considered abnormal.
- 3. Middle Cerebral Artery (MCA):** MCA was visualized in transverse axial view of fetal head at a slightly more caudal plane than the one used for BPD, PI < 1.3 and RI < 0.7 were considered abnormal.

Results

Table 1: Distribution of cases according to presence of IUGR due to uteroplacental insufficiency

IUGR due to uteroplacental insufficiency	No of cases	Percentage
IUGR detected	47	78.3
IUGR not detected	13	21.7
Total	60	100

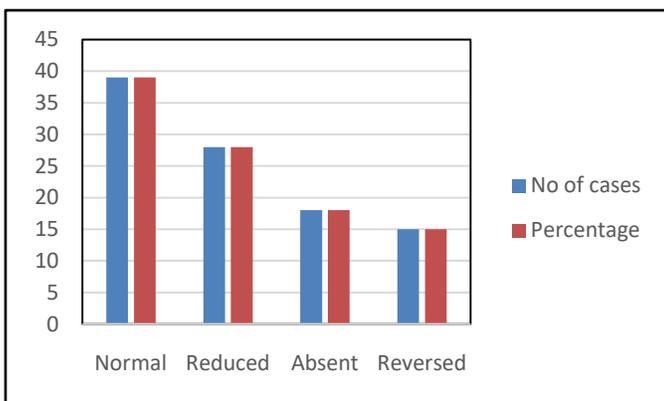
$\chi^2 = 7.1$ P < 0.01 statistically significant



In study population, IUGR was seen in 78.3% cases with uteroplacental insufficiency on uterine artery Doppler.

Table 2: Distribution of cases according to diastolic flow in umbilical artery Doppler study

Diastolic flow in umbilical artery	No of cases	Percentage
Normal	39	39
Reduced	28	28
Absent	18	18
Reversed	15	15
Total	100	100

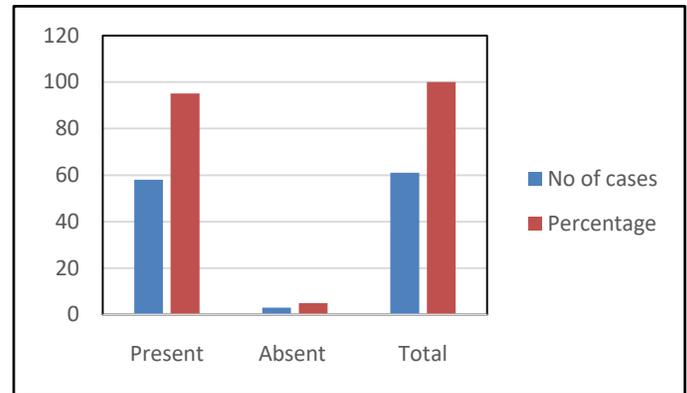


In study population, 39% cases had normal diastolic flow in umbilical artery Doppler, 28% with reduced flow, 18% with absent flow and 15% with reversed flow.

Table 3: Distribution of cases according to presence of IUGR with abnormal umbilical artery Doppler

IUGR with abnormal umbilical artery Doppler	No of cases	Percentage
IUGR detected	58	95.08
IUGR not detected	3	4.92
Total	61	100

$\chi^2 = 13.2$ P < 0.001 statistically highly significant

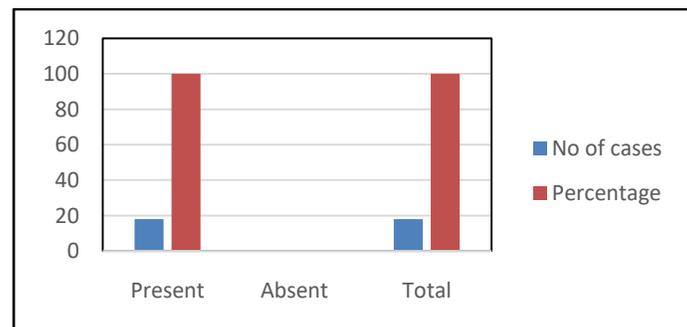


In study population, 95.08% cases had IUGR with abnormal umbilical artery flow and 4.92% had no IUGR.

Table 4: Distribution of case according to presence of IUGR due to Brain sparing effect in middle cerebral artery

IUGR	No of cases	Percentage
IUGR detected	18	100
IUGR not detected	0	0
Total	18	100

$\chi^2 = 16.1$ P < 0.001 statistically highly significant



In study population, 100% cases had IUGR with brain sparing effect on MCA.

Discussion

Table 5: Comparison of cases according to uteroplacental insufficiency in uterine artery Doppler with present study

Uteroplacental insufficiency	KA Douglas et al (2012)	Present study
Present	71%	78.30%
Absent	29%	21.70%

In present study uteroplacental insufficiency in uterine artery Doppler was seen in 78.3% cases compared to 71% in KA Douglas et al (2012).

Table 6: Below table shows comparison of cases according to IUGR due to uteroplacental insufficiency in uterine artery Doppler of present study with Nadeem et al study.

IUGR due to uteroplacental insufficiency in UA Doppler	Nadeem et al (2014)	Present study
Present	68%	71.00%
Absent	32%	29.00%

In present study IUGR due to uteroplacental insufficiency in uterine artery Doppler changes was 71% compared to 68% in Nadeem et al(2014).

Table 7: Below table shows comparison of cases with abnormal umbilical artery Doppler changes of present study with Nadeem et al study.

Abnormal umbilical artery Doppler	Nadeem et al (2014)	Present study
Present	83%	78.30%
Absent	17%	21.70%

In present study abnormal umbilical artery Doppler changes seen in 78.3% cases compared to 83% in Nadeem et al (2014).

Table 8: Below table shows comparison of cases with IUGR due to abnormal umbilical artery Doppler changes of present study with Nadeem et al study.

IUGR due to abnormal umbilical artery Doppler	Nadeem et al (2014)	Present study
IUGR detected	97%	95.08%
IUGR not detected	3%	4.92%

In present study IUGR due to abnormal umbilical artery Doppler changes was 95.08% compared to 97% in Nadeem et al(2014).

Table 9: Below table shows comparison of cases with IUGR due to brain sparing effect in MCA Doppler of present study with Nadeem et al study.

IUGR due to brain sparing effect in MCA	Nadeem et al (2014)	Present study
IUGR detected	97%	100.00%
IUGR not detected	3%	0.00%

In present study IUGR due to brain sparing effect was 100% compared to 97% in Nadeem et al(2014).

Conclusion

- Preeclampsia is associated with significant fetal morbidity and mortality.
- There is progressive fall of vascular resistance in uterine, placental and umbilical arteries as gestational age increases. This will result in high end diastolic blood flow in all these blood vessels.
- Abnormal uterine and umbilical artery Doppler flow velocimetry studies associated with severe form of hypertension and higher incidence of IUGR.
- Absent end diastolic velocity in umbilical artery indicates severe fetal distress and is associated perinatal mortality.

- Abnormal PI of MCA/umbilical artery ratio is also associated with IUGR.
- MCA is less sensitive than umbilical artery.
- Because the changes in the uterine and umbilical circulation strongly correlate with the perinatal outcome, Doppler velocimetry is a primary tool for fetomaternal surveillance in hypertensive pregnancy.
- It is safe, non-invasive technique, easy to perform, easy to interpret and hence most valuable tool in the management of high risk pregnancy.

Summary

Hundred (100) patients diagnosed with preeclampsia between gestational age 31-41 weeks were studied and subjected to colour Doppler ultrasonography.

Uterine, umbilical and fetal middle cerebral arteries were studied. S/D ratio of > 2.6 , RI > 0.58 , persistent early diastolic notch in uterine artery, S/D ratio of > 3 , RI > 0.7 , AEDV and REDV in umbilical artery; RI < 0.7 , PI < 1.3 in middle cerebral artery were considered abnormal. The results were correlated with parameters of perinatal outcome.

1. In our study, age group 20-30 was the common group.
2. In our study group, primigravida were 57%.
3. 68 cases (68%) were between gestational age 31-36 weeks and 32 cases (32%) were between 37-41 weeks.
4. 71 cases (71%) had early diastolic notch on uterine artery Doppler.
5. 60 cases (60%) had uteroplacental insufficiency on uterine artery Doppler, among which in 47 cases (78.3%) IUGR was detected.

6. 61 cases (61%) had abnormal umbilical artery diastolic flow, among which in 58 cases (95.08%) IUGR was detected.
7. 18 cases (18%) had brain sparing effect in middle cerebral artery, among which IUGR was detected in all the cases.

References

1. Chesley LC, A short history of eclampsia, *ObstetGynecol* 1974; 43: 500-602.
2. Hypertension in pregnancy, ACOG Technical Bulletin. 1996; 219: 18.
3. Jenny E Mayers, Philip N Baker, Current opinion in *obstet&gynecol*, 2002; 14:119-25.
4. Walsh SW, Pre-eclampsia: an imbalance in placental prostacycline and thromboxane production. *Am J Obstet Gynecol* 1985; 152: 335-340.
5. Newnham JP. O'Dea MRA, Reid KP et al Doppler flow velocity waveforms analysis in high risk pregnancies: A randomized control trial. *Br J ObstetGynaecol*. 1991; 98: 956-963.
6. Gupta U, Qureshi A and Samal S. Doppler velocimetry in normal and hypertensive pregnancy. *The internet journal of Gynecology and Obstetrics*. 2009; 11:2.
7. Saxena K, Khan T, Tandon R. Umbilical artery flow and its correlation with fetal outcome in normal and hypertensive pregnancy, *Ind Med Gazette*, 1996; 236-239.
8. Fleischer A, Schulmanh, Farmakides G, Bracero L, Blatner Randolph G. Umbilical artery velocity waveforms and intrauterine growth retardation. *Am J ObstetGynaecol* 1985; 151:502-505
9. Nienhius. Doppler ultrasound in suspected IUGR- *Ultrasound Obstet. AndGynaecol* 1997. 9(1):6-13

10. Katherine D Wenstrom. Diverse maternal and fetal pathology associated with absent diastolic flow in the umbilical artery of high risk fetuses. *Obstet and Gynaecol*: 1991; 77:374-378
11. Battaglia C, Artini PA, Galti G et al. Absent or reverse end diastolic flow in umbilical artery and severe intrauterine growth retardation. *Acta Obstet Gynaecol Scand*. 1992; 72:167-171
12. Skoll MA. Doppler velocimetry indices from the abdominal and placental ends of the umbilical artery of growth restricted fetuses- *J Clin. Ultrasound*. 1997 25(8):421-424
13. Morrow JW and Bull SB: Maternal cigarette smoking- The effects of umbilical and uterine blood flow velocity, *Am J Obstet. And Gynaecol*. 1988. 159: 1069-1071
14. Cutis L Lowery Jr: A comparison between umbilical artery velocimetry and standard anti partum surveillance in hospitalized high risk patients- *Am J Obstet. And Gynaecol.*; 1990. 162:710-714
15. Juriy. W Wladimiroff- A review of the etiology, diagnostic techniques and management of IUGR and the clinical application of Doppler in the assessment of placental blood flow – *J. Perinat. Med.*; 1991.19:11-13