

Prediction of IUGR and Adverse Perinatal Outcome by Colour Doppler Examination of UA PI and MCA:UA PI Ratio

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ABSTRACT

Introduction: The most common methods used for evaluation of fetuses identified, as SGA are BPP & NST. Neither of these tests are sensitive for predicting poor outcome in IUGR. It is here that the role of colour doppler comes. Doppler parameters S/D ratio, RI & PI of uterine, umbilical and fetal vessels have been in use for long in predicting perinatal outcome. In present study, we are using ratio of MCA:UA PI. The research was planned to study whether the MCA:UA PI ratio is a better predictor of SGA fetuses and adverse perinatal outcome than the MCA PI or the UA PI used alone.

Material and methods: Prospective study done in pregnant women (30-40 weeks of Gestational. Age) attending antenatal clinics of NIMS Medical College And Hospital, Jaipur from July 2014 to June 2015

Results: Umbilical Artery PI: Out of 50 pregnancies studied, 13 showed abnormal UA PI, among which 11 were SGA & 10 had adverse perinatal outcome. Among remaining 37 pregnancies with normal PI ratio, 3 showed adverse perinatal outcome out of 13 SGA. Middle Cerebral Artery PI: 2 out of 50 pregnancies showed abnormal MCA PI & both fetus were SGA & had adverse perinatal outcome. Out of remaining 48 pregnancies, 11 showed adverse perinatal outcome out of 23 SGA. MCA:UA PI Ratio: 11 of 50 pregnancies showed an abnormal MCA:UA PI ratio & all were SGA & had adverse perinatal outcome. Among remaining 39 pregnancies, 2 patients showed adverse perinatal outcome out of 14 SGA. After applying statistical analysis, its proved that MCA:UA PI RATIO is better predictor of SGA and perinatal outcome than either the MCA PI or UA PI alone.

Conclusion: The MCA:UA PI ratio was a better predictor of adverse perinatal outcome than either the MCA PI or UA PI alone.

Keywords: Umbilical Artery, IUGR, Colour Doppler

72.9–94.5% and specificities of 50.6–83.8% in the prediction of fetuses with birthweight at less than the tenth centile.³ Use of NST to assess fetal condition is not associated with better perinatal outcome; in fact, a systematic review of randomized trials showed that there was a trend towards increased mortality in the group receiving CTG compared with those who did not.⁴ Thus, neither of these tests are particularly sensitive for predicting poor outcome in IUGR pregnancies. It is here that the role of colour doppler comes to detect the abnormal vascular resistance patterns.

Doppler parameters like S/D ratio, RI (Resistance index) & PI (Pulsatility index) of uterine, umbilical and fetal vessels have been in use for long in predicting perinatal outcome. However, in present study, we are using ratio of MCA:UA PI, which remains constant after 30 weeks of gestation. MCA:UA PI ratio and PI of UA (umbilical artery) will help in diagnosis of SGA fetuses & help to predict adverse perinatal outcome.

Aims and objectives of the research were to study whether the MCA:UA PI ratio is a better predictor of SGA fetuses and adverse perinatal outcome than the MCA PI or the UA PI used alone, to study whether the UA PI can be used to identify IUGR per se and to find out relevant statistical data related to above study.

MATERIAL AND METHODS

Prospective study was done in pregnant women (30-40 weeks of Gestational Age) attending antenatal clinics & indoor patients of NIMS Medical College and Hospital, Jaipur over a period of July 2014 to June 2015. On basis of obstetric history & clinical examination, 50 cases of high risk pregnancies were selected. Out of 50, 25 CASE GROUP: decreased AC i.e. < 10th percentile for Gestational Age. SGA was diagnosed based on USG parameters with estimated foetal weight being <10th percentile for GA.

Adverse perinatal outcome

- Fetal bradycardia or tachycardia requiring Casearean section
- Presence of meconium stained liquor
- APGAR score at 5 minutes < 7
- Admission to NICU
- Perinatal morbidity and mortality

INTRODUCTION

The prevention of low birth weight (LBW) is a public health priority in India where, the condition is largely attributed to IUGR. A fetus affected by IUGR forms a subset of cases of Small for Gestational Age (SGA) infants.¹ LBW leads to an impaired growth of the infant with its attendant risks of a higher mortality rate, increased morbidity, impaired mental development and the risk of chronic adult diseases.²

USG helps to identify a heterogeneous group of SGA fetuses that include fetuses with IUGR, fetuses with small constitution, and fetuses with appropriate growth (misdiagnosed as small). The correct detection of the compromised IUGR fetus to allow for timely intervention is the main objective of antenatal care.

The most common methods used for evaluating health in fetuses identified as SGA are the BPP and NST. In high-risk women, AC at less than the tenth centile has sensitivities of

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Examination conducted on GE LOGIQ 500 & VOLUSON 730 PRO with the help of multifrequency convex probe, two to three times.

- ▶ PI of both arteries were observed.
- ▶ MCA:UA PI ratio was calculated.
- ▶ Doppler study was considered abnormal if –
 - UA PI: >2SD
 - MCA PI: <5th percentile
 - MCA:UA PI < 1.08

STATISTICAL ANALYSIS

Microsoft excel software was used to make tables. Descriptive statistics were used to infer results.

RESULTS

Table 1 is showing UA PI (umbilical artery pulsatility index) in adverse perinatal outcome and in SGA. Out of 50 pregnancies studied, 13 showed abnormal UA PI, among which 11 were SGA & 10 had adverse perinatal outcome. Among remaining 37 pregnancies with normal PI ratio, 3 showed adverse perinatal outcome out of 13 SGA.

Table 2 is showing MCA PI (Middle cerebral artery pulsatility index) in adverse perinatal outcome and in SGA. 2 out of 50 pregnancies showed abnormal MCA PI & both fetus were SGA & had adverse perinatal outcome. Out of remaining 48 pregnancies, 11 showed adverse perinatal outcome out of 23 SGA.

Table 3 is showing MCA:UA PI in adverse perinatal outcome and in SGA. 11 of 50 pregnancies showed an abnormal MCA:UA PI ratio & all were SGA & had adverse perina-

tal outcome. Among remaining 39 pregnancies, 2 patients showed adverse perinatal outcome out of 14 SGA.

After applying statistical analysis, its proved that MCA:UA PI ratio is better predictor of SGA and perinatal outcome than either the MCA PI or UA PI alone. Diagnostic accuracy of MCA:UA PI was 72% for SGA and 96% for adverse perinatal outcome.

DISCUSSION

IUGR is a pathological condition characterized by fetal birth weight < 10th percentile for that gestational age. It is strongly related to uteroplacental insufficiency. In IUGR, umbilical blood flow is significantly reduced, mainly due to changes in the placental vascular resistance. Doppler is an important clinical tool for fetomaternal surveillance in high risk pregnancies.

MCA/UA ratio reflects not only the circulatory insufficiency of the umbilical velocimetry of the placenta manifested by alterations in the umbilical S/D ratio but also the adaptive changes resulting in modifications of the middle cerebral S/D ratio.⁷ Because the MCA/UA ratio incorporates data not only on placental status but also on fetal response, it is potentially more advantageous in predicting perinatal outcome. Doppler data combining both umbilical and cerebral velocimetry provide additional information on fetal consequences of the placental abnormality.⁸

In our study out of 13 cases with SGA and adverse perinatal outcome, increase UA PI was seen in 11 and 10 cases respectively. Giles et al⁹ have found that a decrease in the number of resistance vessels in the tertiary stem villi in the placenta

	UA PI in adverse perinatal outcome			UA PI in SGA		
	Present	Absent	Total	Present	Absent	Total
Abnormal PI	10	3	13	11	2	13
Normal PI	3	34	37	13	24	37
	13	37	50	24	26	50

Table-1: UA PI in adverse perinatal outcome and in SGA

	MCA PI for adverse perinatal outcome			MCA PI for SGA		
	Present	Absent	Total	Present	Absent	Total
Abnormal PI	2	0	2	2	0	2
Normal PI	11	37	48	23	25	48
	13	37	50	25	25	50

Table-2: MCA PI in adverse perinatal outcome and in SGA

	MCA:UA PI Ratio in adverse perinatal outcome			MCA:UA PI ratio in SGA		
	Present	Absent	Total	Present	Absent	Total
Abnormal PI	11	0	11	11	0	11
Normal PI	2	37	39	14	25	39
	13	37	50	25	25	50

Table-3: MCA:UA PI in adverse perinatal outcome and in SGA

	Compiled results for SGA					Compiled results for adverse perinatal outcome				
	FN	FP	PPV	NPV	DA	FN	FP	PPV	NPV	DA
UA PI	45.80%	92.30%	84%	64.80%	70%	77%	92%	77%	92%	70%
MCA PI	8%	100%	100%	52%	54%	15%	100%	100%	77%	78%
MCA:UA PI	44%	100%	100%	64%	72%	84%	100%	100%	94%	96%

Table-4: Compiled results for adverse perinatal outcome and SGA

causes an increase in resistance, leading to decreased flow through the UA and an increase in the UA PI.

In our present study of 50 cases, the diagnostic accuracy of MCA:UA PI was 72% for SGA while 96% for adverse perinatal outcome which is comparable to the study of Gramillini et al and Bano et al who also reported that MCA:UA PI has greater diagnostic accuracy. Gramillini et al reported 70% diagnostic accuracy of MCA:UA PI for SGA while 96% for adverse perinatal outcome. Bano et al reported 72.2% diagnostic accuracy of MCA:UA PI for SGA while 95.6% for adverse perinatal outcome.

In our study the diagnostic accuracy of UA PI was 70% for SGA while 78% for adverse perinatal outcome which was correlating with the study of Gramillini et al being 65.5% and 83.3% respectively.

The diagnostic accuracy of MCA PI was 54% for SGA while 78% for adverse perinatal outcome in present study which is also correlating with the study of Bano et al being 54.4% and 77.8% respectively.

Arduini et al¹⁰ also reported that assessment of MCA/UA PI index provide better information in predicting perinatal outcome when compared with umbilical or middle cerebral artery Doppler indices alone.

CONCLUSION

The MCA:UA PI ratio was a better predictor of adverse perinatal outcome than either the MCA PI or UA PI alone. The UA PI can be used to identify IUGR per se. While interpreting UA & MCA PI we have to refer to reference charts to predict perinatal outcome. However, this ratio remains constant in later weeks of pregnancy & this single value alone makes interpretation easier. Hence, Doppler ultrasound especially MCA:UA PI ratio should be an integral component of the routine evaluation of high risk pregnancies as it helps in obstetrical surveillance and management and thereby improving adverse perinatal outcomes.

ABBREVIATIONS

UA = Umbilical Artery, MCA = Middle cerebral Artery, PI = Pulsatility Index, LBW = Low Birth Weight, SGA = Small for Gestational Age, IUGR = Intra uterine Growth Retardation

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