Role of Colour Doppler in Iugr

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Abstract: *Intrauterine growth retardation increases perinatal mortality and morbidity.*
Aim*: we have evaluated the usefulness of various indices of the uterine, umbilical and middle cerebral arteries and their ratios in the prediction of adverse perinatal outcome in intrauterine growth restriction .*
Materials And Methods*: This is a prospective observational study conducted from May 2013 to November 2015 in our Department of Radiology, IOG,Egmore. A total of 100singleton pregnancies were studied and their Doppler indices were studied..*
Conclusion*: Doppler velocimetry of the uterine, umbilical and middle cerebral arteries proved to be a practical and reasonably reliable procedure which complements the biophysical methods of fetal surveillance to determine earlier and more precisely the degree of fetal compromise and aids in deciding the appropriate timing of delivery*
Keywords: *Doppler ultrasound, IUGR,Perinatal mortality.*

I. Introduction

Doppler ultrasound allows for a noninvasive examination of utero-placental and fetal circulation and helps in evaluation and management of fetuses at risk of hypoxia and acidosis secondary to placental insufficiency. Intrauterine growth retardation (IUGR) is defined as an estimated fetal weight below the 10th percentile for the gestational age. It is associated with an increased risk of perinatal mortality, morbidity and impaired neuro-development. In the present study we have evaluated the usefulness of various indices of the uterine, umbilical and middle cerebral arteries and their ratios in the prediction of adverse perinatal outcome in intrauterine growth restriction.

II. Aims And Objectives

1. To evaluate the efficacy of Doppler study of fetal vessels to predict fetuses at high risk for adverse perinatal outcome suspected IUGR.
2. To compare the various Doppler indices of feto-maternal vessels with respect to sensitivity, specificity, positive predictive value, negative predictive value and accuracy.

III. Materials And Methods

This is a prospective observational study conducted from May 2013 to November 2015 in our Department of Radiology, IOG,Egmore. A total of 100singleton pregnancies were studied. All patients were evaluated first by grey scale ultrasound. Fetal weight, AFI and Placental grading wascalculated. We have included uterine artery, umbilical artery and MCA waveform in all patients. Ductusvenosus and umbilical vein were studied when there was increased resistance in umbilical artery with increased diastolic flow in MCA. Expected date of delivery was calculated by Naegele'sformula . The pregnancies were followed up and data were collected regarding mode of delivery, gestational age at birth, birth weight, 5-min Apgar score, number of fetal and perinatal deaths, neonatal complications or morbidity and admission to NICU along with its duration. Pregnancies beyond 24 weeks affected by PIH and/or SFGR or other complications, which were referred to us for antenatal Doppler, were selected. Pregnancies with congenital anomalies, dysmorphism or multiple gestations were excluded. Patients lost to follow up were also excluded. Waveform of uterine artery is obtained in 100 patients, umbilical artery waveform in 100 patients, MCA waveforms in 100 patients, ductusvenosus waveforms in 49 patients and umbilical venous waveforms in 100 patients. Ductusvenosus waveform was not obtained in the rest 51 patients due to technical difficulties. Follow-up examination was done in 8 patients. The patient was examined by the trans-abdominal approach using the 3.5- 5MHz curvilinear transducer Color Doppler machine with 1-3 mm sample volume and low filter.

Interpretation Of Doppler Findings
Doppler study was considered abnormal when-
* Uterine artery having bilateral diastolic notches or mean RI >0.56 or S/D ratio> 2.6 on the side of placenta.
* Umbilical artery S/D ratio more than 3 or more than 95 percentile of reference values [1], pulsatility index more than 95 percentile or if the diastolic flow was absent or reversed.

- MCA/UA PI ratio less than 1 or less than 2 S.D..
- MCA/UA S/D ratio less than 1.
- Ductusvenosus having absent or reversed frequencies in 'a' wave.
- Pulsations present in umbilical vein.

Adverse Perinatal Outcome:
1. Fetal demise (IUD/Stillbirth).
2. Neonatal death within 30 days.
3. 5 min Apgar score < 7.
4. Admission to NICU for >24 hrs.
5. Neonatal morbidity like hyaline membrane disease, intracranial hemorrhage, early onset septicemia, hypoglycemia, or neonatal hyperbilirubinemia.
6. Cesarean section for fetal distress.

Statistical Analysis:
All data was analyzed using the Microsoft Excel software. We calculated the sensitivity, specificity, predictive values and diagnostic accuracy of the above mentioned parameters for predicting adverse perinatal outcome. We used the chi square test to measure proportions.

IV. Observations And Analysis

Table 1: maternal characteristics of study population:

Maternal Characteristics	N	Percentage
Age Groups (Yrs)		
• ≤20	5	5
• 21-25	55	55
• 26-30	28	28
• ≥31	12	12
Parity		
• Primiparous	40	40
• Multiparous	60	60
Pregnancy Complication		
• Maternal Hypertension (Htn)	42	42
• Suspected Fgr (Sfgr)	25	25
• Htn & Iugr	15	15
• Bad Obstetric History (Boh)	36	36
• Oligohydramnios (Oh)	24	24
• Renal Disease (Rd)	1	1
• Post Term Pregnancy (Ptp)	8	8
• Anemia	2	2
Mode Of Delivery		
• Full Term Spontaneous Vaginal Delivery (Ftnd)	12	12
• Induced Vaginal Delivery Full Term (Ftvd) Preterm (Ptvd)	32 19	32 19
• Cesarean Section (Lscs)	37	37
Indication For Cesarean Section (N=37)		
• Fetal Distress (F Dstr)	17	46
• Severe Pre-Eclampsia (Spe)	4	10.8
• Others (O)	16	43.2

Table 2: Neonatal Characteristics Of Study Population (N= 100)

Neonatal Characteristics	N	Percentage
Outcome		
• Live Birth (Lb)	93	93
• Stillbirths (Sb)	7	7
• Neonatal Deaths (Nnd)	11	11
Gestational Age At Birth (Weeks)		
• <30	3	3
• 30-33	13	13
• 34-37	33	33
• ≥38	51	51
Maturity		
• Term Babies (≥32wks)	72	72

• Preterm Babies (<32wks)	28	28
Birth Weight (Grams)		
• ≤1000	3	3
• 1001-1500	18	18
• 1501-2000	26	26
• 2001-2500	22	22
• >2500	31	31
Birth Weight <10th Percentile	80	80
5-Min Apgar Score <7	30	32.26
Admission To Nicu	38	40.86
Duration Of Nicu Stay > 24 Hrs	25	26.88
Neonatal Complications	25	26.88
Mean Birth Weight (Grams ± 2 S.D.)	2119 ±1137	

Adverse Perinatal Outcomes

Adverse Outcome	N	Percentage
• Perinatal Mortality	18	18
• Stillbirth	7	7
• Neonatal Death	11	11
• Intracranial Hemorrhage	2	2
• Neonatal Hyperbilirubinemia	5	5
• Early Onset Septicemia	2	2
• Hypoglycemia	1	1
• 5-Min Apgar Score<7	30	30
• Admission To Nicu >24 Hrs	25	25
• Cesarean Section For Fetal Distress	17	17

Predictive ability for adverse outcome of doppler indices - :

Criterion	Sensitivity (%)	Specificity (%)	Ppv (%)	Npv (%)	Accuracy (%)
Bilateral Notches In Ut A	14.9	94.3	70	55.5	57
Ut A Mean Ri>0.56	70.2	83	78.5	75.8	77
Ut A S/D Ratio> 2.6	46.8	92.4	84.6	66.2	71
Ua S/D > 95th Percentile	39.4	88.6	71.4	67.1	68.1
Ua S/D > 3	71	67.9	61.3	76.5	69.2
Ua Pi > 95th Percentile	59.5	81.1	73.6	69.3	71
Aedv/Redv	19.1	100	100	58.2	62
Mca Pi < Lower Limits	59.5	71.7	65.1	66.6	66
Mca Pi/Ua Pi < (Mean - 2s.D.)	72.3	77.3	73.9	75.9	75
Mca Pi/Ua Pi < 1	53.1	90.5	83.3	68.5	73
Mca/ Ua [S/D] <1	47.3	84.9	69.2	69.2	69.2
Dv Abnormality	14.9	100	100	57	60
All Parameters	93.6	45.3	60.2	88.9	68

V.   Discussion

A growth retarded fetus suffers from high perinatal morbidity as well as mortality . In our study we have recorded various Doppler indices of the feto-maternal vessels and evaluated their efficacy in prediction of intrauterine growth restriction and adverse perinatal outcome.

Maternal characteristics

The study population in the present study was between 25-44 weeks of gestation with mean gestational age in study group being 34.7± 8 wks. In present study, out of 100 pregnancies, 40 (40%) were primiparous and 60 (60%) were multiparous. Our study has a higher number of multiparous women as compared to Lakhkaret al[39]. Their study has a higher cesarean section rate than our study. Our study group shows a higher average birth weight (2119 gm), a lower fraction of preterm babies (28%), a lower NICU admission rate (40.86%) and a slightly lower rate of neonatal complications (26.88%) as compared to their study group (1798.7 gm, 51.7%, 66% & 32.07% respectively).

Uterine Artery Velocimetry

Our results for uterine artery velocimetry show that when the S/D ratio was more than 2.6 with/ without presence of bilateral diastolic notches and there was a higher incidence of adverse outcome.All the patients with bilateral notches were found to have a mean RI >0.56. Presence of bilateral diastolic notches in

uterine artery in our study shows a high specificity (94.3%) but a low sensitivity.. The results of our study for uterine artery S/D ratio>2.6 are in agreement with those of Bhatt et al[13].

Umbilical Artery Velocimetry:

For prediction of adverse perinatal outcome using umbilical artery PI >95 percentile, the results of our study were comparable with those ofGramellini Det al[28]. Using the criterion of umbilical artery S/D ratio with a single cut off value of 3, we noticed a higher sensitivity and negative predictive value as compared to the PI value, but with a slightly lower specificity, positive predictive value and accuracy

Absent (AEDV) and Reversed (REDV) End Diastolic Velocity:

Highly increased resistance to flow in the UA seen as AEDV and REDV is a good marker of hypoxic and acidotic fetuses, who are at higher risk of IUD, perinatal mortality or asphyxia at birth. we find a very high specificity & positive predictive value of 100% each, with a negative predictive value of 58.2%, Accuracy of 62% and a low sensitivity of 19.1% for the prediction of adverse outcome when we encounter ARED. The finding of ARED is associated with a high perinatal mortality. We observed a perinatal mortality of 88.8%in this group. Madzaliet al[40] found that fetuses with AEDV if not delivered will die within 3wks (median 7d). The interval between the occurrence of AEDV in UA and delivery or IUD in our study ranged from 1 day to 8 weeks. Arduini D et al[6] found this range to be 1 to 26 days..

MCA Changes:

In our study, presence of MCA PI value < lower limits has a sensitivity of 59.5%, specificity of 71.7%, positive predictive value of 65.1%, negative predictive value of 66.6%, and Accuracy of 66% for the prediction of adverse perinatal outcome.

Cerebro Umbilical Ratio:

Habek D et al[31] found that cerebro-umbilical ratio is a useful indicator for early detection and assessment of fetal hypoxia.. We have used a cutoff value of 1.0 and mean-2 S.D. values as given by Gramelliniet al[28] for the PI ratio and a cutoff value of 1 for the S/D ratio.[1]. In our study, using MCA PI / UA PI ratio with cutoff value of 1 we obtained lower sensitivity and negative predictive value but a higher specificity and positive predictive value than with the use of gestational age specific cut off values [< mean - 2S.D.] in prediction of adverse perinatal outcome. However the diagnostic accuracy using the two parameters is almost same (73 and 75%).

Venous Circulation Changes:

We have found a mortality of 6/7 in the group of fetuses with venous changes. Two of our patients had pulsations in the umbilical vein and in them we have found a perinatal mortality of 100 % .

Summary and conclusion:

Doppler velocimetry of the uterine, umbilical and middle cerebral arteries proved to be a practical and reasonably reliable procedure which complements the biophysical methods of fetal surveillance to determine earlier and more precisely the degree of fetal compromise and aids in deciding the appropriate timing of delivery. Study of multiplefetal vessels is more useful than umbilical artery alone in prediction of risk.

Acknowledgement

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