Volume : 2 | Issue : 7 | July 2013 • ISSN No 2277 - 8179

Role of colour doppler in predicting adverse foetal outcomes in pre-eclampsia & intra-uterine growth retardation (IUGR).

Medical Science

KEYWORDS : Colour Doppler of Middle cerebral artery (MCA) & Umbilical arteries, pre-eclampsia, IUGR.

Dr. Purvi B. Shah	Consultant obstetrician & gynaecologist; SAVA hospital, Surendranagar.
Dr. Mili V. Dodia	Consultant obstetrician and gynaecologist; Dodia hospital, near jolly bunglow, summair club road, Jamnagar-361005, Gujarat, India.
Dr. Aparna V. Dodia	Intern; Shri M.P. Shah medical college; Jamnagar-361008
Dr. Apoorva V. Dodia	4th year resident in orthopaedics; M.P.Shah medical college, jamnagar.

ABSTRACT

Purpose: To determine and compare the diagnostic performance of Doppler sonography of fetal middle cerebral artery (MCA) and umbilical artery (UA) for prediction of adverse perinatal outcome in suspected intrauterine growth retardation (IUGR) and pre-eclampsia (PET).

Materials and Methods: 116 Singleton pregnancies beyond 30 weeks of gestation complicated by intrauterine growth retardation and severe pre-eclampsia or both were prospectively examined with Doppler sonography of the UA & MCA.

Results: Seventy-two patients of the 116 included in the study population had at least one major or minor adverse outcome. Major adverse outcome criteria included perinatal deaths - including intrauterine and early neonatal deaths, hypoxic ischemic encephalopathy, intra-ventricular haemorrhage, peri-ventricular leukomalacia, pulmonary haemorrhage and necrotizing enterocolitis. Minor outcomes included caesarean delivery for fetal distress, APGAR score below 7 at 5 minutes, admission to neonatal intensive care unit (NICU) for treatment.

Conclusion: S/D ratio of MCA/UA is the most sensitive and specific index in predicting major perinatal adverse outcome (83% and 75%), while umbilical artery S/D ratio is the most sensitive index (66.6%) in predicting any adverse perinatal outcome i.e. including both major and minor outcome. MCA pulsatility index (PI) is the most specific index (90.9%) for predicting in any adverse perinatal outcome. The sensitivity of the Doppler studies can be significantly increased by studying multiple vessels (91.6%). Hence we conclude that Doppler studies of multiple vessels in the fetoplacental circulation can help in the monitoring of compromised foetus and can help us predicting neonatal morbidity. This may be helpful in determining the optimal time of delivery in complicated pregnancies.

Introduction:

- The development of a good utero-placental circulation is essential for achievement of a normal pregnancy.
- Intrauterine growth retardation (IUGR) is associated with an increased risk of perinatal mortality, morbidity, and impaired neurodevelopment.
- The correct detection of the compromised IUGR foetus to allow for timely intervention is a main objective of antenatal care.
- Intrauterine growth restriction (IUGR) is a term used to describe the fetus with a birth weight at or below the 10th percentile for gestational age.
- The IUGR fetus is a fetus that does not reach his potential of growth.
- The two components that are necessary to define an IUGR fetus are: a) birth weight < 10th percentile; b) pathologic process that inhibits expression of the normal intrinsic growth potential.
- The most common methods for evaluating health in foetuses identified as Small for gestational age (SGA) are the biophysical profile (BPP) and the non-stress test (NST). Unfortunately, neither of these tests is particularly sensitive for predicting poor outcome in IUGR pregnancies.
- It is here that role of Colour Doppler comes to detect these abnormal vascular resistance patterns.
- The important issue is not the identification of small fetus, but rather the "fetus at risk" for compromise.

Objective:

The objective of this study is to determine and compare the diagnostic performance of Doppler sonography of fetal middle cerebral artery (MCA) and umbilical artery (UA) for prediction of adverse perinatal outcome in suspected intrauterine growth retardation (IUGR) and pre-eclampsia (PET).

Materials & Methods:

❖ **Study Design**

- Study type-Prospective comparative study
- Study was carried out at the obstetrics and gynaecology department of a tertiary level hospital
- Timeframe-1 and ½ year
- 58 singleton pregnancies beyond 30 weeks of gestation complicated by intrauterine growth restriction or severe pre-eclampsia or both were prospectively examined with Doppler ultrasonography of the UA, MCA.

❖ **Doppler Vascular Technique**

- Study of various fetal vessels was performed using pulsed Doppler ultrasound (LOGIQ C5 GE Medical systems, Waukesha, Wisconsin) with 3.5 MHz curvilinear probe with a high pass filter.
- The following vessels were studied with the mother in a recumbent position during foetal inactivity and apnoea.
  - 1. Umbilical Artery (UA)
  - 2. Middle Cerebral Artery (MCA)
- The above vessels were located in the standard plane.
- The umbilical artery measurements were made from free loop of cord midway between the placental and abdominal wall insertion.
- The middle cerebral artery was located in a transverse plane at the level of the lesser wing of the sphenoid bone with sample gate placed on proximal portion of the vessel.
- Flow velocity waveforms, the resistance index (R.I), pulsatility index (P.I), systolic/diastolic ratio (S/D) of umbilical artery, middle cerebral artery were noted.

❖ **Assessment standards:**

- S/D ratio, resistance and pulsatality index of umbilical artery (>2SD), middle cerebral artery (<5th percentile) for the gestational age according to the standard reference values
- Umbilical artery RI reference was according to Kurmanavicius et al
- The reference value of umbilical artery P.I., cerebro-umbilical ratio are according to Dandolo Gramellini et al and MCA P.I. ratio are according to Giancarlo Mari et al.
- Rajan et al reference values were taken for umbilical artery S/D ratio.
- The ratio examined were considered abnormal when
  - P.I. of MCA/UA < 1

❖ **Scrutiny for Outcomes**

- **Major** adverse outcome criteria included perinatal deaths - including intrauterine and early neonatal deaths, hypoxic ischemic encephalopathy.
- **Minor** outcomes would include cesarean delivery for fetal distress, APGAR score below 7 at 5 minutes, admission to neonatal intensive care unit (NICU) for treatment.

Observation and discussion:

▪ **Maternal, Fetal and Perinatal characteristics of study population**

1) Parity: Total number of primigravida patients was 70 and multigravida patients were 46, so it would be 60.3% and 39.7% in percentage respectively.

2) Pregnancy complications:

a. Pre-eclampsia - 16 patients (13.7%)
b. Intrauterine Growth Restriction - 42 patients (36.3%)
c. Pre-eclampsia and IUGR - 58 patients (50.0%)

3) Mode of Delivery:

a. Spontaneous vaginal delivery - 6 patients (5.1%)
b. Induction of labour - 38 patients (32.7%)
c. Caesarean section - 72 patients (62.0%)

▪ **Maternal Characteristics:**

1) Indications for caesarean section
a. Fetal distress - 28 patients (38.8%)
b. Severe pre-eclampsia - 08 patients (11.2%)
c. Others - 36 patients (50.0%)

2) Perinatal outcome
a. Stillbirth - 10 patients (08.6%)
b. Survival - 92 patients (79.3%)
c. Neonatal death - 14 patients (12.6%)

Table 1: Neonatal characteristics of study population

POG at Birth (weeks)	35.8	
Live Births	53	
Stillbirth	5	
Term babies	28	(48.2%)
Preterm babies	30	(51.7%)
Av. Birth weight (gram)	1798.7 grams	
Birth Weight (gm)		
>2,500	6	(10.3%)
1,500-2,500	31	(53.4%)
1,000-1,500	17	(29.3%)
<1,000	4	(6.8%)
Apgar at 5'<7	4	
Admission to NICU	35	(66%)
Neonatal Complications	17	(32.07%)
Duration of stay > 10 days	15	(42.8%)

▪ Neonatal complication developed: Out of 106 live births.

1) Hypoglycaemia - 2
2) Hypocalcaemia - 2
3) Polycythemia - 2
4) Neonatal hyperbilirubinemia - 28

Table 2: Diagnostic accuracy of Doppler in predicting adverse perinatal outcome

Index	Sensitivity(%)	Specificity (%)	PPV (%)	NPV (%)
U.A R.I	44.4	81.8	80	47.3
U.A P.I	50	59	66.6	41.9
U.A S/D	66.6	45.4	66.6	45.4
MCA P.I	41.6	90.9	88.2	48.7
P.I Of MCA/UA	57.2	89.3	90	55
Multiple Vessels Analysis	72	93	94	65

Conclusion:

- Hence we conclude that Doppler studies of multiple vessels in the fetoplacental circulation can help in the monitoring of compromised fetus and can help us predict neonatal morbidity.
- This will be helpful in determining the optimal time of delivery in complicated pregnancies.

REFERENCE

1. Kurmanavicius J, Florio I, Wisser J, et al. Reference resistance indices of the umbilical, fetal middle cerebral, uterine arteries at 24-42 weeks of gestation- Ultrasound in Obstetrics and Gynecology 1997. | 2. Gramellini D, Folli MC, Raboni S, Vadora E, Merialdi A. Cerebral - Umbilical Doppler Ratio as a Predictor of Adverse Perinatal Outcome - Obstetrics and Gynecology 1992; 79:416-20. | 3. Mari G, Deter RL. Middle cerebral artery flow velocity waveforms in normal and small for gestational age fetuses-American journal of obstetrics and gynecology 1992; 166:1262-1270. | 4. Chauhan R, Samiksha Trivedi - Role of Doppler study in high risk pregnancy - journal of obstetrics and gynecology of India Vol 52, No. 3: May/June 2002. | 5. OTT WJ. Comparison between the non stress test and the evaluation of centralization of blood flow for prediction of neonatal compromise using USG. Ultrasound in Obstetrics and Gynecology 1999; 14:38-41. |