



## Role of Uterine Artery, Umbilical Artery and Middle Cerebral Artery Doppler In Normal Pregnancies And High Risk Pregnancies In Relation To Perinatal Outcome

**DR.K.KALAIVANI**

PROFESSOR & HOD, Govt. RSRM Lying in Hospital, Stanley Medical College, Royapuram, Chennai-13, Tamil Nadu.

**DR. J.BETTY AGNES**

Assistanat Professor, Govt. RSRM Lying in Hospital, Stanley Medical College, Royapuram, Chennai-13, Tamil Nadu.

### ABSTRACT

**OBJECTIVE:** To evaluate the role of Doppler ultrasound in high risk singleton pregnancies in comparison with normal singleton pregnancies by use of uterine artery , umbilical artery , middle cerebral artery Doppler indices as prediction of adverse perinatal outcome.

**STUDY DESIGN :** It is a prospective case control study .250 patients was taken for study.125 patients belonged to high risk group(severe preeclampsia, IUGR,Rh negative, severe anaemia, oligohydromnios).125 patients belonged to normal group.

**RESULTS:** The mean birth weight , mean APGAR Score ,mean AFI were significantly lower in study group ,the mean duration of stay in NICU was prolonged by 6 days in study group, the incidence of LSCS for foetal distress was more in study group when compared to control group. The perinatal mortality rate was also high in study group with abnormal Doppler indices when compared to normal group.

**CONCLUSION:** Foetal Doppler study indices which are used to check integrity of utero placental and fetoplacental circulation give a concise picture of circulation abnormality and thence to forewarn adverse perinatal outcome.

### KEYWORDS

**ROLE OF UTERINE ARTERY INTRODUCTION:** Doppler ultrasound in high risk pregnancies to assess the utero placental circulation –uterine artery, fetoplacental circulation- umbilical artery , fetal circulation – fetal middle cerebral artery .Doppler indices have been used to obtain information involving blood flow and vascular impedance that cannot be obtained from absolute velocity information alone.The indices depend on ratio involving the systolic peak velocity (A), the end diastolic peak velocity(B), and the mean velocity throughout one cycle(mean).

#### The three primary indices used clinically are :

1. S/D : PEAK SYSTOLIC VELOCITY/END DIASTOLIC VELOCITY. ( A/B)
2. RESISTANCE INDEX (RI) : PEAK SYSTOLIC – END DIASTOLIC /PEAK SYSTOLIC VELOCITY.(A-B/A)
3. PULSATILITY INDEX (PI) : PEAK SYSTOLIC – END DIASTOLIC VELOCITY/MEAN VELOCITY .(A-B/M)

Among these indices resistance index slightly more sensitive in finding abnormal wave forms because the denominator never become zero.

The Pulsatility index is the most sensitive index in sensing abnormal wave forms because it takes into account the mean velocity.

Doppler velocimetry has shown a clear distinction between normal and abnormal waveforms. Abnormal umbilical artery waveform defined by S/D ratio are greater than or equal to 3 after 30 wks of pregnancy. When abnormal waveform persist ,fetal growth retardation and adverse perinatal outcome ensues. Abnormal uterine artery waveform are also identified by S/D ratio averaged from both vessels of more than 2.6 after 26 weeks. In addition persistent diastolic notching is considered abnormal. Abnormal uterine vessels waveform strongly correlate with future development of preeclampsia, IUGR. It provide a basis for new clinical and basic research into disease process and methods for improving perinatal and maternal mortality.

#### MATERIALS AND METHODOLOGY:

The study was prospective case control study where women

with singleton pregnancies complicated with high risk factors such as severe preeclampsia , IUGR, recurrent pregnancy loss, gestational or overt diabetes, Rh negative, severe anaemia, oligohydramnios were taken as test and compared with normal singleton antenatal women without any risk factor ,taken as a control.

During the study period of one year from May 2015 to May 2016,250 patients who met the study criteria were included in to the study , out of which 125 belonged to normal group, another 125 belonged to high risk group.

Doppler examination was performed in clinically indicated cases to determine a favourable or worsening blood flow; however only the result of final Doppler ultrasound were used for analysis of the perinatal outcome. These patients were followed up and the mode of delivery , birth weight, apgar score, NICU admission were compared in both groups.

The Doppler flow velocity wave form of umbilical artery were obtained from a loop of cord in the absence of foetal breathing / body movement, a clear waveform is obtained. The uterine artery velocimetry was obtained immediately after the vessel crosses the hypogastric artery and before it divide into the small uterine and cervical branches. The middle cerebral artery Doppler waveform were obtained at the level of sphenoid bones. Colour flow imaging was used to display the circle of willis.

The parameters studied are pulsatility index and the flow pattern in the umbilical artery because PI reflects the change in resistance to flow even during absence or reversal of flow through the vessel. The pulsatility index is distributed normally in the third trimester. The umbilical artery pulsatility index greater than 95<sup>th</sup> percentile for the gestational age was taken as abnormal.

The presence of a notch in the uterine artery waveform and the increase in the resistance index more than 95<sup>th</sup> Percentile for that gestational age were considered abnormal.

The MCA pulsatility index was considered abnormal if the value was below 5<sup>th</sup> percentile.

The MCA PI/UA PI ratio cut off value of less than 1.08 was taken as abnormal.

Doppler ultrasound results were analysed for the prediction of perinatal outcome ;abnormal Doppler results were compared with outcome such as birth weight, perinatal death, emergency caesarean section for foetal distress, low APGAR score , admission to NICU .Pregnancy outcome were taken as adverse when any of the above complications were present.

**RESULTS:**

Various Doppler indices for each vessel such as THE UTERINE ARTERY - resistance index(RI), presence of uterine artery diastolic notch, THE UMBLICAL ARTERY – pulsatility index(PI) , the umbilical artery end diastolic flow, THE MIDDLE CEREBRAL ARTERY - pulsatility index (PI), cerebro placental ratio(CPR), were compared among normal pregnancy and high risk pregnancies with relation to adverse perinatal outcome.

**ELEVATED UMBLICAL ARTERY PULSATILITY INDEX WITH ADVERSE PERINATAL OUTCOME:**

UMBILICAL ARTERY PI	PERINATAL ADVERSE	OUTCOME NORMAL	TOTAL	P VALUE
Positive	38	7	45	
Negative	19	61	80	<0.001
Total	57	68	125	

**Chi-square test ABNORMAL MCA PI AND ADVERSE PERINATAL OUTCOME:**

PARAMETER	PERINATAL ADVERSE	OUTCOME NORMAL	TOTAL
Abnormal MCA PI	52	59	111
Normal MCA PI	5	9	14
Total	57	68	125

**CEREBROPLACENTAL RATIO: (RATIO OF MCA PI TO UMBLICAL ARTERY PI)**

CPR	GROUP			P VALUE
	HIGH RISK	NORMAL	TOTAL	
<1.08	45	0	45	
>1.08	80	125	205	<0.001
TOTAL	125	125	250	

**Chi-square test**

The sensitivity of uterine artery RI in predicting adverse perinatal outcome was low (17.3%).The persistence of uterine artery diastolic notch was also associated with adverse perinatal outcome.

The sensitivity of umbilical pulsatility index in predicting adverse perinatal outcome was 67%and specificity was 89.7% and was compared with other studies .Umbilical artery diastolic flow abnormalities also had association with adverse perinatal outcome.

The sensitivity of MCA PI in predicting adverse perinatal outcome was 91.2% but the specificity was very low, 13.2%.

Cerebro placental ratio has both, comparable sensitivity of 68.4%,and specificity of 91.1% which highly correlated with other previous studies and is better predictor of adverse perinatal outcome with maximum diagnostic accuracy of 80.8%.

Among the high risk group preeclampsia had maximum incidence 20.8% and among combination of risk factors IUGR and oligohydramnios constituting 10.4% . Maximum Doppler changes seen in IUGR and oligohydramnios combination .

The mean birth weight ,mean APGAR score, mean AFI were significantly lower in the study group when compared to con-

trol group. The mean duration of stay in NICU was prolonged in the study group by the 6days. The incidence of LSCS for foetal distress was more in the study group when compared to the control group. The perinatal mortality rate was also high in the study group with abnormal Doppler indices when compared with the normal group.

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