# CORRELATION BETWEEN FETAL AORTIC ISTHMUS DOPPLER VELOCIMETRY AND THE CEREBRO-PLACENTAL RATIO IN CASES WITH FETAL GROWTH RESTRICTION

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## INTRODUCTION

FGR is one of the leading causes of intrauterine fetal demise (IUFD), emergency cesarean section (ECS), and perinatal death. The main cause of FGR is placental insufficiency that provokes fetal circulatory hemodynamic adaptation.

Assessment of the umbilical artery (UA) and middle cerebral artery (MCA) Doppler is the well established clinical practice in monitoring of fetuses with FGR. Cerebroplacental ratio (CPR) is MCAPI / UAPI and it has been noted that the CPR is decreased with decompensation of FGR.

Fetal aortic isthmus (AoI) Doppler has recently been suggested as a useful prognostic marker in monitoring of FGR fetuses as AoI velocity indices are lower and resistance indice sare higher in them than normal fetuses.

Anatomically, the aortic isthmus is located between the origin of the left subclavian artery from the arch of the aorta and the connection of the ductus arteriosus in the descending aorta.

## AIM OF THE WORK

The aim of this study was to evaluate the relation between the aortic isthmus (AoI) Doppler velocimetry and cerebroplacental ratio (CPR) on the perinatal outcome in cases with fetal growth restriction (FGR).

## PATIENTS AND METHODS

We Studied 2 groups. Group A: 50 cases are normal control and group B: 50 cases are FGR. All cases had scanned at the ultrasound unit of EL-Shatby Maternity University Hospital, between 28-37 weeks.

Doppler interrogation of 3 vessels had been underwent in all cases; namely: umbilical artery, middle cerebral artery and aortic isthmus. Umbilical artery had been sampled at afreeloop. Middle cerebral artery had been sampled at the proximal part of the near-field MCA (M1). Cerebroplacental ratio (CPR) then calculated by dividing the PI of MCA by the PI of UA (MCA PI / UA PI). Aortic isthmus (AoI) had been sampled in the sagittal plane of the aortic arch by placing the sample gate few millimeters caudal to the origin of the left subclavian vein.

All cases were assessed after delivery for Apgar score at 5 minutes and admission to the neonatal intensive care unit (NICU).

## RESULTS

There were a statistically significant differences between CPR & Ao-I-PI (values & percentiles) between the 2studiedgroupsatboth visits. There were no statistically significant differences between CPR in group A at both visits. There were also no statistically significant differences between AoI-PI in group A at both visits.

CPR in group B in the 2nd visit is statistically significantly higher than in the 1st visit and also higher than CPR in group A in both visits. AoI-PI in group B at the 2nd visit is statistically significantly higher than in the 1st visit and also higher than AoI-PI in group A in both visits.

**Table 1:** Comparison between the two studied groups according to AoI-PI at the 2nd visit

| PI of the 4 vessels at the 2nd visit | Group A (n = 50) | Group B (n = 50) | U | p |
|---|---|---|---|---|
| **AoI PI (2nd)** | | | | |
| **Min. – Max.** | 2.0 – 3.0 | 2.40 – 3.60 | 614.0* | <0.001* |
| **Mean ± SD.** | 2.62 ± 0.37 | 3.02 ± 0.37 | | |
| **Median (IQR)** | 2.80 (2.30 – 2.90) | 3.0 (2.71 – 3.40) | | |

Table 1 showed that there were statistical significant differences between the two studied groups as regard the systolic to pulsatility index (PI) of the AoI at the 2nd visit as the p value was <0.001. Data of tables 1 is explained in figure: 1.

**Table 2:** Comparison between the two studied groups according to CPR at 2nd visit

| CPR at 2nd visit | Group A (n = 50) | Group B (n = 50) | Test of Sig. | p |
|---|---|---|---|---|
| **CPR (2nd)** | | | | |
| **Min. – Max.** | 1.54 – 3.89 | 0.66 – 1.91 | U= 148.0* | <0.001* |
| **Mean ± SD.** | 2.22 ± 0.54 | 1.34 ± 0.40 | | |
| **Median (IQR)** | 2.11 (1.90 – 2.52) | 1.42 (0.92 – 1.64) | | |
| **CPR percentile (%) (2nd)** | | | | |
| **Min. – Max.** | 14.0 – 99.0 | 1.0 – 40.0 | U= 120.0* | <0.001* |
| **Mean ± SD.** | 62.20 ± 28.31 | 11.28 ± 11.89 | | |
| **Median (IQR)** | 72.0 (32.0 – 89.0) | 7.0 (1.0 – 14.) | | |
| **CPR percentile (Normal VS Abnormal) (2nd)** | | | | |
| **Normal** | 50 (100.0%) | 31 (62.0%) | $\chi^2$= 23.457* | <0.001* |
| **Abnormal** | 0 (0.0%) | 19 (38.0%) | | |

Table 2 showed that there were statistically significant differences between the two studied groups as regard the cerebroplacental ratio (CPR) value and percentile at the second visit as the p value of these variables were both <0.001. 38% of cases of group B were had an abnormal CPR percentile at the 2nd visit. Data of table 2 is explained in figures: 2.

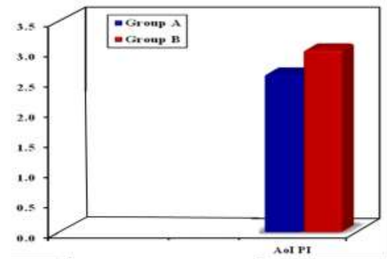


**Figure 1:** Comparison between the two studied groups according to AoI-PI at the 2nd visit

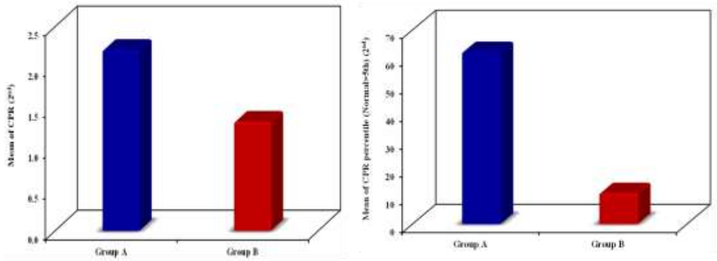


**Figure 2:** Comparison between the two studied groups according to CPR value (left graph) and percentile (right graph) in the second visit

## CONCLUSION

Abnormalities in the pulsatility index of fetal aortic isthmus (AoI-PI) and cerebroplacental ratio (CPR) in fetuses with growth restriction had association with adverse perinatal outcome.

The sensitivities of AoI-PI and CPR at the second visit in group B to predict adverse neonatal outcome were: 44.66% and 67.74% respectively. The specificities of AoI-PI and CPR at the second visit in group B to predict adverse neonatal outcome were: 62.11% and 61.22% respectively.