IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 15, Issue 4 Ver. VII (Apr. 2016), PP 63-68
www.iosrjournals.org

Cerebral – Placental Ratio One of Predictors of Perinatal Outcomes in Preeclampsia

Robert Qirko[1], Alma Lelcaj[2],Elton Koroveshi[3], BledarBenja[4],AlojvaXhelilaj[5]
[1]*PhD, MD University of Medicine, Tirana, Medical Faculty, Obstetrics & Gynecology Department*
[2]*University of Medicine, Tirana – Faculty of medical applied sciences*
[3]*MD "Queen Geraldine" University Hospital*
[4]*MD German Hospital*
[5]*MD*

Abstract: *the aim of this study is to evaluate the cerebro – placental ratio and its influence in postnatal outcomes in pregnancies complicated with preeclampsia. Evaluation of this ratio and its values will be evaluated based on fetal outcomes.*
Methods: *In this study were involved 106 patients diagnosed with preeclampsia or gestational hypertension hospitalized in the "Queen Geraldine" Universitary Hospital during the time period 1 october 2010 – 31 july 2012. In every patient was performed Doppler flow velocityand the result of the last Doppler examination performed before labor was taken into consideration. The cerebro-placental ratio, (PI ACM/PI AU) is considered abnormal or inverted when its value is lower than 1. Were evaluated the fetal weelbeing imediately after delivery and in first days after birth. Correspondenting values were evaluated.*
Results: *The patients were evaluated based on their mothers' age, prematurity, apgar in first and fifth minute, method of delivery, corresponding IUGR or fetal weight. Mortality and morbidity of newborns were evaluated based on their ratio of cerebral – placental blood flow in utero. The same evaluation including amniotic fluid were the base of evaluation for IUGR, preeclampsia severity and fetal outcomes.*
Conclusions: *Cerebral – placental blood flow velocity can be used to decide the time of delivery for preeclamptic women. Fetal outcome is often compromised in cases with inverted flow velocity. Abnormal cerebral – placental blood flow velocity will result in higher rate of Section Cesarean delivery. Morbidity and mortality will be improved if we consider cerebral – placental ratio.*

I. Objective

The aim of this study was to evaluate the role of cerebro-placental ratio as a predictor of adverse perinatal outcomes in pregnancies complicated by preeclampsia.

II. Background

Hypertensive disorders represent the most common complications of pregnancy, with a reported incidence from 5-10% of all pregnancies.[1] These disorders are a major cause of maternal and perinatal morbidity and mortality.[2] In the mother, one of the earliest characteristics of the disease is the deficitary infiltration of the spiral arteries from the trophoblast, thus not turning them in uteroplacental arteries.[3] This affects the blood flow in the uterine artery.[4] In the fetus there is a poor vascularisation of the terminal villi, stromal villous hemorrhage and hemorrhagic endovasculitis[5,6] or even obliteration of the chorionic villi.[7,8]

Being a non-invasive technique in studying the blood circulation, echo-Doppler has become one of the ideal methods to examine the fetal and maternal circulation measuring flow velocityin the umbilical artery and the cerebri media artery.

The cerebro-placental ratio (cerebri media artery PI/umbilical artery PI) is an indicator of the distribution of fetal peripheral circulation and in the AGA fetuses is > 1.[9]Lower values of this ratio, when the ratio is nearly 1 or lower, are considered pathological.In these conditions there is a considerable vasospasm in most fetal territories, like pulmonary, splancnic, scheletal and muscular, and an increase in the perfusion of brain, heart and adrenal glands.[10-14] This phenomena, known as "brain-sparing", intends to compensate the fetal hypoxia as an adapting mechanism to prevent severe brain damage.[15] The Cerebro-Placental Ratio is also reported as a good predictor of fetal outcome and can be used to identify fetuses at risk for morbidity and mortality.[16-19] It is strongly related to fetal hypotrophy, low birth weight and low pH, a shorter time of deliveryand need for emergent labor.[20]

III. Materials And Methods

In this study were involved 106 patients diagnosed with preeclampsia or gestational hypertension hospitalized in the "Queen Geraldin" Gynecologic Obstetric Universitary Hospital during the time period 1 october 2010 – 31 july 2012.

Patients were evaluated according to their: age, parity, presence of associating diseases or not, place of residence, gestational age confirmed by the date of the last menstruations as well as by ultrasound, method of labor, by Cesarean section or vaginal delivery and the presence of complications of severe preeclamsia like HELLP syndrome and eclampsia.

In every patient was performed Doppler flow velocityand the result of the last Doppler examination performed before labor was taken into consideration. The cerebro-placental ratio, (PI ACM/PI AU) is considered abnormal or inverted when its value is lower than 1.

In the newborn were evaluated: Apgar score in the first and fifth minute, birth weight, prematurity, size according to gestacional age, SGA, AGA or LGA, presence of fetal hypotrophy (IUGR), amount of amniotic fluid, normal or reduced, and perinatal mortality.

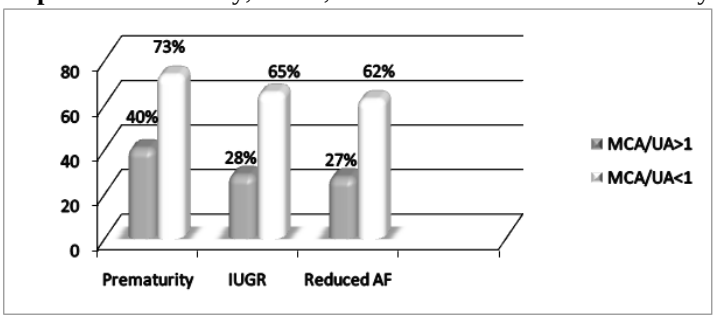
IV. Results

To evaluate the role of flow velocity in the pregnanciescomplicatedwithpreeclampsia, the patients and the newborn are dividedinto 2 groups related to the MCA/UA ratio, whetheritis normal or inverted. The results are shown in the table below :

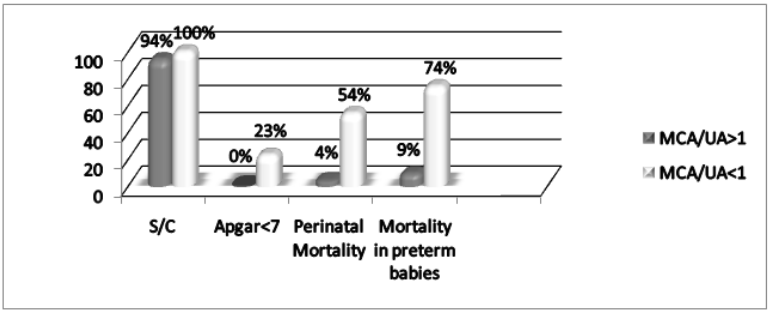
Table 1

Characteristics	MCA/UA > 1 (normal)	MCA/UA <1 (inverted)	p
Patients averageage	**29.57+ 3.4 years**	**28.86+ 3.0 years**	**NS**
Averagegestationalage	**37.07 weeks**	**32.78 weeks**	
Delivery method			**p<0.05**
SectioCesarea	**94%**	**100%**	
Vaginal delivery	**6%**	**0%**	
Newborn'saverageweight	**2832 gr**	**1658 gr**	**p<0.05**
Prematurity	**40%**	**73%**	**p<0.05**
IUGR	**28%**	**65%**	**p<0.05**
Reducedamnioticfluid	**27%**	**62%**	**p<0.05**
Perinatalmortality	**4%**	**54%**	**p<0.05**
Preterm babies mortality	**9%**	**74%**	**p<0.05**
Apgar < 7 in the V minute	**3.5%**	**23%**	
AverageApgar			
I minute	**8.23**	**6.8**	
Vminute	**9.49**	**7.38**	

Graphic 1. Prematurity, IUGR, reduced AF related toflow velocity



Graphic 2. Delivery method, Apgar and perinatalmortalityrelated to flow velocity.



V. Discussions

1. Patient'sage

In our study the average patients age is 29.02 years old.

Average age in our study is generale higher than other similar studies.

1. Most patients being pregnant for the first time, we can conclude that the age of the first pregnancy in albanian women has increased.
2. In our study we have patients of over 39 years old (10.38% of all patients) which have a considerable effect on the average age.

Studies	Patient'saverageage	
SerapYalti and co-workers	27.6±6.9 years old	29.1±7.5 years old
Our study	28.86±3.0 years old	29.57 ±3.4 years old

In ourstudy, as in the foreign one, thereis no significantdifferencebetweeninverted flow and averageage. Evenstatistically, agedifferenceis not significant (p>0.05)

2. Average gestational age

Gestational age in our study was calculated in two ways, first day of the last menstruations and by ultrasound, which result respectively 36 and 34.5 weeks. There is a difference between them because in the cases with preeclampsia fetal hypotrophy is very common (in our study it was present in 37% of the cases).

Studies	Average gestational age	
	MCA/UA>1	MCA/UA<1
D.Simanaviciute, S.Gudmundsson	35 weeks	31.2 weeks
SerapYalti and co-workers	37.3±1.6 weeks	37.5±1.9 weeks
Our study	**37.07 weeks**	**32.78 weeks**

In ourstudy, as in othersimilarones, the difference in the gestationalage in weeksbetween the group with normal flow and the one withinverted flow isalmos the same. The inverted flow group has a lowergestationalagethan the normal one, this due to the factthatinverted flow occurs more often in severepreeclampsiawhichpresentsearlier, and alsobecause IUGR and otherfetalproblems are complicatedwithinverted flow more oftenthanpregnancies on term or near the term.

3. Grade of preeclampsia

According to the results obtained from the patients in this study, 64% of them had severe preeclampsia, 33% moderate and only 3% mild. The difference between these results is also statistically significant (p<0.05). This high number of cases with severe preeclampsia can be explained by the fact that these patients need to be hospitalized for a more specialized treatment.

4. Parity

In our study, primiparouscases are visiblyhigher, with 62% of all cases, against 38% multiparous, similar to other studies, considering that primiparity is one of the known risk factors of preeclampsia.

Studies	Parity	
D.Simanaviciute, S.Gudmundsson	73.90%	26.10%
Oluranti B and co-workers	51.6%	48.4%
Helewa M and co-workers	64%	36%
Our study	**62%**	**38%**

5. Delivery method

Studies		
D.Simanaviciute, S.Gudmundsson	66.70%	93.10%
SerapYalti and co-workers	35.30%	75%
Eser A and co-workers	66%	88.46%
Our study	**94%**	**100%**

If we compare the percentage of Cesarean section related to flow velocitywith other studies, you can see that in our study these values are higher in both groups.

The high number of S/C in the cases with inverted flow is explained by the fact that this phenomenon is an indication for immediate interruption of pregnancy. Something to be further discussed or studied is the fact

that even in the cases with normal flow velocity,S/C is performed in a much higher percentage than in other countries.

6. Prematurity

Studies	
Buchbinder et Al	66.70%
HNAT et Al	33.00%
Helewa M and co-workers	37%
Our study	**48%**

In this study, prematurity is high, 48%, almost the same as term deliveries. Comparing to other studies, premature deliveries in SUOGJ are more frequent than in other countries. This can be explained by the fact that in this hospital there many hospitalized patients from other cities, which are always severe cases, for a more specialized treatment.

This argument is based on the data of the place of residence of the patients included in this study, which showed that 44% of the patients live in Tirana, while most of them, 56% are from other cities. The difference between preterm cases with normal and inverted flow velocity,respectively 40% against 73%, is also statistically significant ($p<0.05$).

7. In Utero Growth Retardation (IUGR)and reduced amniotic fluid (AF)

These two pathologies result in high rates (IUGR 37%, reduced AF 35%) compared to other studies, this due to the fact that in this hospital are hospitalized many cases from other cities (56% compared to 44% from Tirana), which are always severe cases.

These pathologies also have a strong association between them, noticing that 73% of IUGR fetuses are preterm and 58% of IUGR fetuses have reduced AF.

Studies	
Buchbinder et Al	16.20%
J. Bar and co-workers	19.6%
Hauth et Al	28.70%
Harrington K and co-workers	35.20%
Our study	**37%**

Besidesfrom the association betweenthem, these pathologies arestronglyrelatedwithflow velocity. IUGR wasfoundin 28% of cases with normal flow velocity and in 65% of cases withinvertedflow velocity ($p<0.05$), thisbecause not only IUGR is an important factor ofdelivery but alsothe evaluation of flow velocitywhich has influenced on a higherpercentagedelivered cases. That meansthat in cases withhypotrophy,deliverywas made afterflow velocitywasinverted.

Studies		
D. Simanaviciute, S.Gudmundsson	26.20%	71.40%
Our study	**28%**	**65%**

In cases with inverted flow velocityis also more frequent the presence of reduced AF, 62% compared to 27% of the patients with reduced AF in the cases with normal flow velocity ($p<0.05$).

8. Apgar score

Average Apgar of the I minute in our study is 7.9 and is higher compared to other studies. This result shows that application of s/c delivery at such a high rate is effective related to the fetal outcome, since in other countries that apply this way of delivery in lower percentage, the newborn's Apgar immediately after delivery is lower.

Studies		
D.Simanaviciute, S.Gudmundsson	4.80%	10.30%
Our study	**3.50%**	**23%**

Asignificantdifferencecanbenoticedin the cases withinverted flow, where Apgar < 7 in ourstudyisfound in 23% of cases. Wecansaythat the way of delivery and adaption of the newborn in the V minute in this cases must bereconsidered. This meansthatmaybeweshouldn'talwayswait for the flow velocity to invert to performdelivery, sincethisisassociatedwith more complications and neonatalmortality.

9. Newborn's average weight

Studies		
SerapYalti and co-workers	3292.9 gr	2892.5 gr
D.Simanaviciute, S.Gudmundsson	2319.1 gr	1364.1 gr
Our study	**2832 gr**	**1658 gr**

In our study, similar to others, there is a difference of more than 1000 gr in the newborn's weight, which can be explained with prematurity and fetal hypotrophy whichinfluence birth weight and which are always at high rates in the newborns with inverted flow.

10. Perinatal mortality

Studies	
HNAT et Al	1.40%
Hauth et Al	2.80%
Begum MR and co-workers	3.13%
Buchbinder et Al	8.90%
Oluranti B and co-workers	37%
Gong Yun-hui and co-workers	10.8%
Okamura K and co-workers	16.7%
Our study	**15%**

In our study, perinatal mortality results in 15% of cases, which is considered high, compared to other similar studies. Various arguments can be used to explain this high level of perinatal mortality in our study:

1. High percentage of prematurity in the cases of this study (48%).
2. High rate of mortality in premature cases (31%).
3. High percentage of newborns with Apgar < 7 in the V minute, which is related to neonatal adaptation.
4. High association of mortality with inverted flow (82% of the deceased babies).
5. Fetal hypotrophy (IUGR) in the major part of the deceased babies (65%).
6. The major part of the patients (64%) have severe preeclampsia, which is related to higher neonatal morbidity and mortality, mostly in cases when its major complication, HELLP syndrome, is developed.In our study this complication results with a mortality of 50%.

The relation between flow velocity and mortality can be confirmed by the fact that in the cases with inverted flow, mortality is 54% against 4% in the babies with normal flow. The difference is high, 50%, and it's statistically significant ($p<0.05$).

In the last point of discussion about perinatal mortality related to flow velocity,is considered only the rate of mortality in preterm cases. This intends to establish if there really is a relation between inverted flow and neonatal mortality, since all the deceased babies part of this study are preterm, and can be assumed that the cause of death is prematurity, regardless of inverted or normal flow.

So, in cases with inverted flow, mortality in preterm babies is 74%, while in cases with normal flow it is only 9%. So, even though preterm, babies with normal flow have a more than 60% lower mortality compared to those with inverted flow, a statistically significant difference ($p<0.05$). These results clearly show the important influence of flow velocity on perinatal mortality.

VI. Conclusions

1. Flow velocityis one of the evaluationmethods to select the best delivery time in patients with preeclampsia to reduce the complications for mother and fetus.
2. Fetal outcome is often compromised in cases with inverted flow velocity.
3. The higher rate of S/C deliveries in cases with preeclampsia influence on a better fetal outcome.
4. The value of C/P ratio is very important for the evaluation of perinatal morbidity in preeclampsia. The correct intervention will reduce perinatal mortality.

Bibliografy

[1]. Report of the National High Blood Pressure Education Program. Working Group Report on High Blood Pressure in Pregnancy. Am J ObstetGynecol 183:S1, 2000.
[2]. Sibai BM: Diagnosis and management of gestational hypertension and preeclampsia. Obstet Gynecol 102:181, 2003.
[3]. Brosens IA, Robertson WB, Dixon HG (1972) The role of the spiral arteries in the pathogenesis of preeclampsia. Obstet Gynecol Ann 1:177.
[4]. Campbell S, Diaz-Recasens J, Griffin DR, Cohen-Overbeek TE, Pearce JM, Wilson K, Teague M (1982) New Doppler technique for assessing uteroplacental blood flow. Lancet 8326:675-677.
[5]. Kingdom JCP, Burrel SJ, Kauffmann P (1997) Pathology and clinical implications of abnormal umbilical artery Doppler waveforms. Ultrasound Obstet Gynecol 9:271-286.

[6]. Kingdom JCP, Rodeck CH, Kauffmann P (1997) Umbilical artery Doppler: more harm than good? Br J Obstet Gyneacol 104:393-396.
[7]. Divon MY, Ferber A (2001) Umbilical artety Doppler velocimetry: an update. Semin Perinatology 25:44-47.
[8]. Divon MY, Ferber A (2002) Doppler evaluation of the fetus. Clin Obstetrics Gynecology 45:1015-1025
[9]. Gramellini D, Folli MC, Raboni S et al. (1992) Cerebral- umbilical Doppler ratio as a predictor of adverse perinatal outcome. Obstet Gynecol 79: 416- 420.
[10]. Cohn HE, Sacks EJ, Heymann MA, Rudolph AM (1974) Cardiovascular responses to hypoxemia and acidemia in fetal lambs. Am J Obstet Gynaecol 120: 817- 824.
[11]. Wladimiroff JW, van de Wijngaard JA, Degani S, Steëart PA (1987) Cerebral and umbilical arterial blood flow velocity waveform in normal and growth retarded pregnancies. Obstet Gynecol 69: 705-709.
[12]. Arbeille P, Maulik D, Laurini R (eds) (1999) Fetal hypoxia. Parthenon, London.
[13]. Itskovitz J, LaGamma EF, Bristoë J, Rudolph AM (1991) Cardiovascular response to Hypoxemia in sinoaortic- denervated fetal sheep. Pediatr Res 30: 381- 385.
[14]. Ensen A, Roman C, Rudolph AM. Effects of reducing uterine blood flow on fetal blood flow distribution and oxygen delivery. J Dev Physiol 1991; 15: 309–323.
[15]. Lindsay H (1997) Pregnancy and iron deficiency. Nutr Rev 4: 91- 101.
[16]. Bahado- Singh R, Kovanci E, Jeffres A et al. (1999) The Doppler cerebroplacentar ratio and perinatal outcome in intrauterine growth. Am j Obstet Gynecol 180: 750-756.
[17]. Makhseed M, Jirous J, Ahmed MA, Viswanathan DL (2000) Middle cerebral artery to umbilical artery resistance index ratio in the prediction of neonatal outcome. Int J Gynecol Obstet 71: 119-125.
[18]. Neilson JP, Alfirevic Z. Doppler ultrasound for fetal assessment in high risk pregnancies. Cochrane Database Syst Rev 2000 :CD000073.
[19]. Severi FM, Bocchi C, Visentin A. Uterine and fetal cerebral Doppler predict the outcome of third-trimester small-for-gestational age fetuses with normal umbilical artery Doppler. Ultrasound ObstetGynecol 2002; 19: 225–228.
[20]. Sterne G, Shields LE, Dubinsky TJ (2001) Abnormal fetal cerebral and cerebral and umbilical Doppler measurements in fetuses with intrauterine growth restriction predicts the severity of perinatal morbidity. J Clin Ultrasound 29: 146-151.