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Comparison of Umbilical Cord Blood Gas Profiles Between Preeclamptic and Healthy Mothers

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ABSTRACT

Preeclampsia defined as hypertension and proteinuria after 20 weeks of gestational age is a serious maternal placental pathology leading to fetal hypoxia. Neonatal hypoxia is a potential threat to newborn's health and mandates exclusive care. Antenatal umbilical artery blood gas is a reliable indicator of fetal hypoxia. The present study aims to compare umbilical cord blood analysis and APGAR score between preeclamptic and healthy mothers 40 singleton pregnant women with preeclampsia were compared with 40 age-matched healthy mothers undergoing caesarean section with gestational age more than 28 weeks who referred to perinatology clinic. Umbilical cord blood gas profile and APGAR scores were compared between the two groups. Umbilical cord pH and O2 pressure were significantly lower in preeclamptic mothers. Although CO2 pressure was considerably lower in control group, the difference did not reach a statistically significant point. Both APGAR score and birth weight were higher in babies of healthy mothers compared to those with preeclampsia. There is strict correlation between umbilical blood gas profile and preeclampsia which can reliably propose existence of fetal hypoxia. Blood gas analysis of umbilical cord in preeclamptic mothers can determine the requirement of more intensive care to babies of these mothers.

Key words: Comparison, Cord Blood Gas Profiles , Healthy Mothers

INTRODUCTION

Maternal and especially placental health status during pregnancy directly affects fetal development and normal growth[1]. There are several maternal conditions that contribute to placental insufficiency like gestational diabetes mellitus (GDM) and preeclampsia which can compromise fetal development[2]. Preeclampsia is a serious maternal placental pathology leading to feral complication. Preeclampsia is defined as hypertension (SBP>140 or DBP>80) detected on two occasions at least 6 hours apart after 20 weeks of gestational age plus proteinuria. Pathologic edema can accompany the condition. In pre-existing essential hypertensive patients it is defined as increased SBP >= 30 mmHg or DBP>= 15 mmHg. This disorder affects 2-6% of healthy nulliparous women in the U.S. while affecting 4-18% of mothers in developing countries. Preeclampsia is associated with both maternal and fetal complication. Most important fetal complications are intrauterine growth retardation (IUGR) and prematurity.

Most antenatal assessments are designed to detect fetal asphyxia[3]. Umbilical cord blood gas analysis in a newborn is the gold standard measure

for fetal hypoxia; especially when base excess is greater than 12-16 mmol/lit[4].

On the other hand APGAR score is closely associated to fetal metabolic acidosis[5-8]. Despite extensive investigations on preeclamptic maternal blood profile, there are few studies conducted on umbilical cord blood gas of newborns of mothers suffering from preeclampsia[1]. We aim to compare APGAR scores of first and fifth minutes after birth as well as umbilical cord blood gas profile of newborn of preeclamptic mothers to normal pregnancy.

MATERIALS AND METHODS

All singleton pregnant women with diagnosed preeclampsia and gestational age more than 28 weeks undergoing caesarean section who referred to Zeinab Hospital Perinatalogy clinic between Jan 2014 and December 2014 were invited to participate in the study. Mothers with blood pressure > 140/80 and proteinuria greater than 300 mg in 24 hour urine specimen were considered as the case group. Same number of age and gestational age matched pregnant women who were candidate for caesarean section were allocated in the control group.

Mothers with gestational age less than 28 weeks, multifetal pregnancy, Rh negative blood groups, mothers with renal, cardiopulmonary, hepatic or essential hypertensive disorders, and those whose pregnancies were terminated due to placenta abruption, cord prolapse or positive oxytocin challenge test were all excluded from the study.

Ethics

Present study was approved and supervised by the committee for human research ethics, Shiraz University of Medical Sciences. Patients were included in the study with written informed consent.

Study protocol

Patients were followed up according to routine schedule for pre-natal evaluation of preeclamptic and healthy mothers prior to delivery. Standard procedure of caesarean section was performed between 36-38th week of gestational age. In both case and control groups, umbilical cords were clamped on both sides right after delivery. Arterial blood samples were collected in pre-heparinized TB syringe and analyzed within 30 minutes of sampling. PH, base excess, O2 pressure CO2 pressure and bicarbonate were assessed in 37° c by pH and gas analyzer (RAPIDLab 248/348 Systems, Siemens health care, Germany). Umbilical cord blood gas profile analysis and APGAR score of first and fifth minutes after birth were measured and recorded for all patients.

Newborn assessment: mothers in both case and control group were closely monitored by fetal heart rate as soon as having labor pain till delivery. APGAR score was recorded in first and fifth minutes post section. All means of advance resuscitation for the newborns were available. Babies who required neonatal resuscitation were transferred to neonatal intensive care unit.

Analysis

Umbilical cord blood gas profile and APGAR scores were compared within and between groups using independent samples T-test and Chi-Square test of SPSS software version 18 for windows. P value < 0.05 was considered statistically significant.

RESULTS

During a 5 month period (since October 2014 till February 2015) 80 mothers, 40 normal and 40 severe preeclamptic pregnancies, entered the study. Mean age of study population was 28.3 years (95% CI: 26.9-29.5) with no significant variation between to study groups (p-value: 0.857). Mean gestational age was 37.7 ± 1.1 weeks (95% CI: 37.3-38.1) in the case group while it was 35.5 ± 2.8 (95% CI: 34.5-36.4) in preeclamptic mothers (statistically significant variation; p-value < 0.001). Birth1 weight was significantly lower in babies from mothers with preeclampsia compared to healthy mothers (2491 gr vs. 3097 gr. P-value < 0.001). Descriptive values and reports regarding umbilical cord blood gas and birth weight are brought in table 1. For pH and O2 partial pressure, there was a significant difference between groups showing lower O2 pressure and more acidic pH in mothers

Table 1: Comparison of blood gas profile and birth weight between study groups

	Preeclampsia (95% CI)	Control (95% CI)	P-value
pH	7.30 (7.26-7.34)	7.37 (7.35-7.38)	0.004
HCO_3	25.6 (23.9-27.1)	25.5 (23.9-27.1)	0.815
PCO_2	47.2 (43.8-50.5)	43.4 (40.2-46.6)	0.078
PO_2	12.1 (7.1-17.1)	24.1 (18.2-29..9)	0.002
Birth weight	2491 gr (2250-2732)	3094 gr (2961-3233)	< 0.001

with preeclampsia compared with healthy individuals. Partial pressure of CO_2 was remarkably higher in preeclamptic mothers although it did not reach statistical significance. No significant variation was noted between groups regarding bicarbonate ion concentrations.

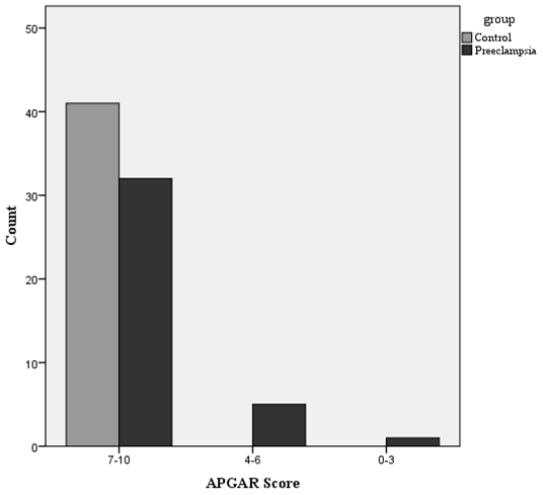

Fig. 1. Distribution of neonates in groups regarding their APGAR scores

APGAR scores in first and fifth minutes after delivery were also compared between groups showing significantly higher rate of low APGAR scores in preeclampsia group. figure 1. In preeclamptic group, 20% of neonates had APGAR scores between 4-6 and one case between 0-3, while in healthy controls, 100% of babies had high APGAR scores[7-10] (P-Value: 0.03).

DISCUSSION

Preeclampsia is a placental vascular disorder in which feto-maternal exchange of nutrition and gases is compromised. Neonatal hypoxemia is a significant determinant of neonates' requirement for resuscitation and its outcome. Fetal hypoxemia has been reported to occur more frequently in neonates from preeclamptic mothers[9], however evidence is lacking regarding early antenatal hypoxemia in babies from mothers with preeclampsia.

Preeclampsia compromises placental gas exchange and fetal oxygenation. Decreased fetal placental oxygenation leads to fetal acidosis and if severe asphyxia. All fetal assessment tools are designed to determine fetal asphyxia which directly correlates with APGAR score and the consequent neonatal complications. This study is conducted to assess the correlation between first and fifth minutes with umbilical cord blood acidosis and gas measures.

There is no significant difference shown between the control group and the high risk preeclamptic mothers regarding O_2 pressure, PH , bicarbonate and base excess. Mean ± SD for umbilical cord CO_2 pressure has shown meaningful reverse correlation to APGAR scores.

This finding emphasizes the importance of the latter value to determine neonatal complications caused by preeclampsia.

CONCLUSION

Our study highlights a significant correlation between umbilical cord blood CO2 pressure and the APGAR scores. We recommend assessing umbilical cord blood CO2 pressure in newborns of preeclamptic mothers.

Conflict of interest

All the authors of present study certify that they do not have any involvement in any organization with financial or non-financial interests.

None of the authors of this article report any conflict of interests. Financial support was provided by Shiraz University of Medical Sciences

REFERENCES

1. Cristina Catarino IR, Luís Belo, Alexandre Quintanilha and Alice Santos-Silva., Umbilical Cord Blood Changes in Neonates from a Preeclamptic Pregnancy, From Preconception to Postpartum, Dr. Stavros Sifakis (Ed.), ISBN: 978-953-51-0353-0, InTech, DOI: 10.5772/31665. Available from: http://www.intechopen.com/books/from-preconception-to-postpartum/umbilical-cord-blood-changes-in-neonates-from-a-preeclamptic-pregnancy, 2012.
2. Matsuo K, Malinow AM, Harman CR, Baschat AA. Decreased placental oxygenation capacity in pre-eclampsia: clinical application of a novel index of placental function preformed at the time of delivery. *Journal of perinatal medicine.* **37**(6):657-61 (2009).
3. Armstrong L, Stenson BJ. Use of umbilical cord blood gas analysis in the assessment of the newborn. Archives of disease in childhood Fetal and neonatal edition. **92**(6):F430-4 (2007).
4. Ahmadpour-Kacho M, Asnafi N, Javadian M, Hajiahmadi M, Taleghani N. Correlation between Umbilical Cord pH and Apgar Score in High-Risk Pregnancy. *Iranian journal of pediatrics*. **20**(4):401-6 (2010).
5. ACOG Committee Opinion No. 348, November 2006: Umbilical cord blood gas and acid-base analysis. *Obstetrics and gynecology.* **108**(5):1319-22 (2006).
6. Manganaro R, Mami C, Gemelli M. The validity of the Apgar scores in the assessment of asphyxia at birth. *European journal of obstetrics, gynecology, and reproductive biology.* **54**(2):99-102 (1994).
7. Boehm FH, Fields LM, Entman SS, Vaughn WK. Correlation of the one-minute Apgar score and umbilical cord acid-base status. *Southern medical journal*. **79**(4):429-31 (1986).
8. Ruth VJ, Raivio KO. Perinatal brain damage: predictive value of metabolic acidosis and the Apgar score. BMJ (Clinical research ed). **297**(6640):24-7 (1988).
9. Backes CH, Markham K, Moorehead P, Cordero L, Nankervis CA, Giannone PJ. Maternal Preeclampsia and Neonatal Outcomes. *Journal of Pregnancy.* 2011 (2011).