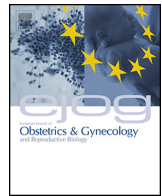




Contents lists available at ScienceDirect

European Journal of Obstetrics & Gynecology and Reproductive Biology

journal homepage: www.elsevier.com/locate/ejogrb



Maternal tissue blood flow and oxygen saturation in pre-eclampsia and intrauterine growth restriction

V.L. Karanam^{a,c,*}, N.M. Page^a, N. Anim-Nyame^{a,b}

^aSchool of Life Sciences, Kingston University London, UK

^bDepartment of Obstetrics and Gynaecology, Kingston Hospital, London, UK

^cKings Mill Hospital, Mansfield, UK

ARTICLE INFO

Article history:

Received 5 December 2013

Received in revised form 17 February 2014

Accepted 31 March 2014

Keywords:

Pre-eclampsia

Intrauterine growth restriction

Maternal tissue blood flow

Oxygen saturation

Strain gauge plethysmography

Pulse oximeter

ABSTRACT

Objective: To investigate the hypothesis that impaired maternal tissue perfusion occurs in pre-eclampsia and intrauterine growth restriction (IUGR) and this correlates with maternal tissue oxygenation.

Study design: Strain gauge plethysmography was used to compare maternal calf blood flow during the third trimester in 16 women with pre-eclampsia, 6 women with IUGR and 16 normal pregnant controls. A Mediad iPOX pulse oximeter was used to measure maternal tissue oxygenation in the three groups and these were compared with tissue blood flow.

Results: Maternal tissue blood flow was significantly reduced in pre-eclampsia compared to the two other groups ($p = 0.003$). Blood flow was significantly reduced in pre-eclampsia compared to IUGR ($p = 0.03$). However there was no difference in blood flow between normal pregnancy and IUGR groups ($p = 0.76$). No significant difference was noted in maternal tissue oxygenation between the normal pregnancy, pre-eclampsia and IUGR groups (mean \pm S.E.M. [97.13 \pm 0.4, 96.69 \pm 0.33, 97.83 \pm 0.47 respectively], $p = 0.26$). No correlation was noted between blood flow and tissue oxygenation in the three groups of women.

Conclusion: We have demonstrated that reduced maternal resting tissue blood flow present in women with pre-eclampsia is not seen in women with IUGR and the reduction in blood flow in pre-eclampsia is not associated with changes in maternal tissue oxygenation.

© 2014 Elsevier Ireland Ltd. All rights reserved.

Introduction

Pre-eclampsia is a multi system disorder of the second half of pregnancy, which is characterized by increased vascular reactivity and peripheral resistance with pathological changes that are consistent with impaired blood flow to the affected vascular beds [1]. In severe pre-eclampsia, there is generalized vasoconstriction with multiple organ dysfunction [2]. There is also considerable evidence that generalized endothelial dysfunction underlies the clinical manifestations of the disease [3].

It has been demonstrated that peripheral nutritive blood flow is impaired in pregnancies complicated by pre-eclampsia and precedes onset of the disorder [4]. Furthermore, the clinical manifestations of the disorder are suggestive of tissue hypoxia [5]. Studies on oxygen delivery and consumption indices in women with severe pre-eclampsia showed that the changes were similar to that observed in distributive shock [6]. However, so far it is not clear

whether the reduced blood flow correlates with maternal tissue oxygenation. IUGR is a recognized complication of pre-eclampsia however IUGR may occur in the absence of pre-eclampsia. *De novo* IUGR and pre-eclampsia appear to share the same primary pathology with endothelial dysfunction as a central feature [7,8]. However, it is unclear whether the generalized endothelial dysfunction seen in IUGR is associated with reduced maternal tissue perfusion and/or impaired tissue oxygenation. In this study we hypothesized that the reduced blood flow seen in women with pre-eclampsia is also present in pregnancies complicated by IUGR and this is associated with impaired maternal tissue oxygen saturation. To investigate this hypothesis, maternal tissue blood flow and oxygen saturation was measured in women with pre-eclampsia, IUGR and normal pregnancy.

Materials and methods

Study subjects and demographics

In a cross sectional study during the third trimester, we compared maternal tissue blood flow and oxygen saturation

* Corresponding author at: Kings Mill Hospital, Mansfield, UK.

Tel.: +44 7810091121.

E-mail addresses: docvijuk@hotmail.com, docvijuk@gmail.com (V.L. Karanam).

<http://dx.doi.org/10.1016/j.ejogrb.2014.03.042>

0301-2115/© 2014 Elsevier Ireland Ltd. All rights reserved.

between 16 women with pre-eclampsia, 6 women with pregnancies complicated with IUGR and 16 women with normal pregnancy. All the study participants were recruited from Kingston Hospital maternity unit and were matched for maternal age, BMI and gestational age. Gestational age was determined by first trimester ultrasound scan. Informed written consent was obtained from all the participants and the study was approved by the local research and development committee.

Pre-eclampsia was defined as new onset hypertension of more than or equal to 140/90 mmHg on two separate occasions at least 4 h apart and with significant new onset proteinuria after 20 weeks of gestation and reversal of both by six weeks after delivery [9]. Proteinuria was considered significant if the urinary protein creatinine ratio was more than 30 mg/mmol or a 24 h urine collection showed more than 300 mg protein. IUGR was established by foetal weight and size below the fifth centile, along with asymmetrical pattern of growth measurements on ultrasound [10]. Women with known medical disorders or pregnancy related complications that may result in IUGR such as pre-eclampsia with IUGR or with a history of TORCH (toxoplasmosis, congenital syphilis and other viral infections, including rubella, cytomegalovirus and herpes simplex) and substance misuse (recreational drug use) were not included in the study. None of the babies born showed any signs of chromosomal abnormalities. All women recruited for the study had early first trimester scan which was used for calculating the gestational age.

Study protocol

The study was performed in a quiet room with a temperature range of 23–24 °C. Blood flow was measured using Filtrass strain-gauge plethysmograph (Filtrass; DOMED, Munich, Germany). The device is mercury-free, with an integrated automatic calibration system [11]. Briefly, the congestion pressure cuff was placed around the right thigh with the women on left lateral position and enclosed in a rigid corset. The venous congestion pressure was raised rapidly by 40 mmHg and the pressure was held for 20 s. Since this pressure occludes venous return, but not arterial blood inflow, the initial swelling rate will equal arterial blood flow. The change in circumference of the calf was estimated from the slope of the first 3 s of the volume response to the pressure step. This procedure was repeated three times, with the congestion pressure kept at zero for 5 min between each of the measurements. The system analysis programme calculates the change in circumference and uses it to estimate the blood flow in ml/min/100 ml⁻¹. A Mediaid iPOX Pulse Oximeter (960 series, Mediaid Inc.) with a universal hinged oximetry sensor which is routinely used in many clinical situations was used to compare the oxygen saturation in the three groups of women [12]. Arterial blood pressure was measured non-invasively in the ipsi-lateral calf and arm, using a Dinamap Vital Sign Monitor (Type 1800; Critikon, Tampa, FL, USA).

Statistical analysis

All the data were normally distributed and the results are presented as means ± S.E.M. Statistical differences between the groups were compared using one way ANOVA with Bonferroni correction for multiple comparisons. Pearson correlation coefficients were calculated and a forward multiple regression analysis performed to detect any associations between blood flow and tissue oxygen saturation. This was also used to determine any correlations with clinical and biochemical variables. Statistical significance was assumed at $p \leq 0.05$. GraphPad Prism version 6 was used for the analysis.

Results

Table 1 shows the clinical and demographic characteristics of the three groups of women. The pre-eclamptic group had significantly higher systolic and diastolic blood pressures compared to the IUGR and normal pregnant groups ($p = 0.001$). None of the women with pre-eclampsia or IUGR required antihypertensive medication. As expected IUGR babies were significantly smaller compared to babies born to mothers with pre-eclampsia without IUGR and normal pregnant controls ($p = 0.0001$). There were no significant differences in maternal age and haemoglobin levels between the groups. However, women with pre-eclampsia were delivered at significantly earlier gestational age ($p = 0.0004$), had lower haematocrit ($p = 0.014$) and platelet counts ($p = 0.043$) compared to the other groups.

Comparison of maternal tissue blood flow in normal, pre-eclampsia and IUGR pregnancies

Calf blood flow was significantly reduced in the pre-eclampsia group compared to the other groups (1.050 ml/min/100 ± 0.101 ml/min/100 ml; 2.104 ml/min/100 ± 0.228 ml/min/100 ml and 1.95 ml/min/100 ± 0.594 ml/min/100 ml for pre-eclampsia, normal pregnancy and IUGR respectively (ANOVA, $p = 0.003$) (Fig. 1). Calf blood flow was significantly reduced in pre-eclampsia compared to the normal pregnant controls ($p = 0.002$) and IUGR group ($p = 0.03$). There was no difference in blood flow between the normal pregnant controls and the IUGR women ($p = 0.76$).

In the normal pregnancy group, there was no correlation between blood flow and any of the clinical and demographic parameters such as maternal age ($r = 0.061$, $p = 0.823$), gestational age ($r = 0.039$, $p = 0.825$), systolic blood pressure ($r = 0.09$, $p = 0.740$), diastolic blood pressure ($r = 0.180$, $p = 0.505$), haemoglobin levels ($r = 0.09$, $p = 0.740$) or haematocrit ($r = 0.034$, $p = 0.901$). However, there was a significant positive correlation between the blood flow and platelet levels ($r = 0.525$, $p = 0.037$). Nonetheless, there was no correlation between blood flow and any of the clinical, demographic or laboratory parameters. In the IUGR group, there was a significant positive correlation between

Table 1

Clinical and demographic characteristics of the normal, IUGR and pre-eclamptic subjects. Values are expressed as mean ± S.E.M.

Variable	Normal	Pre-eclampsia	IUGR	<i>p</i> value
Mean maternal age (years)	33.62 ± 0.87	33.62 ± 0.83	34.66 ± 1.02	0.73
Gestational age (weeks)	39.37 ± 0.27	37.06 ± 0.50	36.5 ± 0.56	0.0004
Nulliparity	10	10	3	
Normal delivery	8	7	2	
Caesarean section	8	9	4	
Haematocrit	0.352 ± 0.003	0.348 ± 0.006	0.390 ± 0.014	0.014
Platelets (10 ⁹ l ⁻¹)	256.18 ± 11.39	185 ± 23.56	216.33 ± 9.97	0.043
Haemoglobin (gm/dl)	11.88 ± 0.17	11.76 ± 0.27	12.8 ± 0.503	0.205
Systolic blood pressure (mmHg)	118.93 ± 1.60	154.37 ± 2.4	120.33 ± 2.98	0.0001
Diastolic pressure (mmHg)	75.25 ± 1.86	99 ± 2.06	79.66 ± 1.89	0.0001
Mean birth weight (g)	3406.37 ± 70.28	2854.06 ± 149.6	2190 ± 66.08	0.0001

Download English Version:

<https://daneshyari.com/en/article/6173713>

Download Persian Version:

<https://daneshyari.com/article/6173713>

[Daneshyari.com](https://daneshyari.com)