Original Research Paper

International Physiology
Vol. 5 No. 1, January - June 2017
DOI: https://dx.doi.org/10.21088/ip.2347.1506.5117.7

Sympathetic Vascular Reactivity and Development of Pregnancy Induced Hypertension and Preeclampsia: A Hypothesis

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Abstract

Introduction: Pregnancy is a physiological condition associated with profound adaptive changes in the maternal hemodynamics and cardiovascular system. Autonomic nervous system plays a central role in this adaptation to the various needs of pregnancy. One of the well known complication, that occurs commonly during pregnancy is pregnancy induced hypertension (PIH)/ preeclampsia (PE). Impairment of autonomic functions has been suggested as one of the cause of pregnancy induced hypertension. As sympathetic vascular reactivity has been reported as one of the indicators of autonomic status to predict the development of hypertension. Therefore, this study was undertaken to assess sympathetic vascular reactivity in the first and second trimesters of pregnancy. *Materials and Methods:* The study was conducted in the Department of Physiology, Uttar Pradesh University of Medical Sciences (UPUMS), Saifai, Etawah, in association with Department of Obstetrics and Gynaecology. The pregnant females in first and second trimesters reporting to the Out Patient Department (OPD) of Obstetrics and Gynaecology were included in the study. They were subjected to the Cold Pressor Test for the assessment of sympathetic vascular reactivity in sitting position by the method as described by Hines and Brown. *Results:* A total of 14 subjects were recruited in the study (7 subjects were in the first trimester and another 7 were in the second trimester). The 51.7 percent of the subjects during first trimester turned out to be the hyper- reactors while in second trimester this was true for the 71.4 percent of the subjects. *Conclusion:* As the subjects even in the first trimester showed increased blood pressure reactivity, thus it is hypothesised that assessment of sympathetic vascular reactivity reflected as blood pressure reactivity from early pregnancy may be a useful indicator for development of pregnancy induced hypertension and preeclampsia in later pregnancy.

Keywords: Pregnancy; Autonomic Functions; Sympathetic Vascular Reactivity; Pregnancy Induced Hypertension; Preeclampsia.

Introduction

Pregnancy is a physiological condition associated with profound adaptive changes in the maternal hemodynamics and cardiovascular system. Autonomic nervous system plays a central role in this adaptation to the various needs of pregnancy [1].

One of the well known complication, that occurs commonly during pregnancy is pregnancy induced hypertension (PIH)/ preeclampsia (PE) affecting 5% to 8% of all pregnancies. It is one of the most common cause of maternal and neonatal morbidity & mortality [2,4].

PIH is defined as a syndrome that arises in pregnancy and is diagnosed by presence of hypertension (blood pressure of 140/90 mmHg or more for the first time in pregnancy, on two separate occasions) first detected after 20 weeks of gestation [2-4].

PE is defined as PIH with proteinuria of at least 0.3g per 24 hours in a previously normotensive and non-proteinuric patient [5]. It develops in the second half of pregnancy and resolves shortly after delivery [1].

Impairment of autonomic functions has been suggested as one of the cause of pregnancy induced hypertension. There have been reports of greater resting sympathetic output in cases of pregnancy induced hypertension as compared to normal pregnancy [1].

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Received on: January 17, 2017 **Accepted on:** April 04, 2017

The central sympathetic output has also been found to be increased to a much greater extent in women with pregnancy induced hypertension as compared to normal pregnant women [5]. In some studies, increased sympathetic activity as well as decreased vagal tone has been found to be associated with pregnancy induced hypertension/preeclampsia [6,7].

Although it usually becomes apparent only in the third trimester of pregnancy, evidences are available that underlying pathophysiological abnormalities appear early in the pregnancy [8].

There have been attempts for early prediction of pregnancy induced hypertension (PIH)/ preeclampsia (PE) by using a variety of biological, biochemical and biophysical markers. But early prediction is still insufficient in clinical practice [9,10].

As sympathetic vascular reactivity has been reported as one of the indicators of autonomic status to predict the development of hypertension. Therefore, this study was undertaken to assess sympathetic vascular reactivity in the first and second trimesters of pregnancy.

Materials and Methods

The study was conducted in the Department of Physiology, Uttar Pradesh University of Medical Sciences (UPUMS), Saifai, Etawah, in association with Department of Obstetrics and Gynaecology after clearance from institutional ethical committee. The pregnant females in first and second trimesters reporting to the Out Patient Department (OPD) of Obstetrics and Gynaecology were included in the study.

After explaining the procedure of CPT to the subjects, the informed written consent to participate in study was taken from each subject. A detailed history was taken to rule out any chronic illness.

The subjects were requested to sit in peace for 10 minutes. After 10 minutes of rest they were subjected to the Cold Pressor Test for the assessment of sympathetic vascular reactivity in sitting position by the method as described by Hines and Brown [11]. The subject were seated comfortably and baseline BP was recorded by auscultatory method using mercurial sphygmomanometer. Then the subject was asked to immerse one hand up to the wrist in ice cold water (4-5 degree Celsius) for one minute. The blood pressure (BP) was recorded after one minute with immersed hand. After the recording with immersed hand the subject was requested to take out the hand from cold water and further BP was measured after one minute. The change in the systolic blood pressure (ΔSBP) and diastolic blood pressure (ΔDBP) was calculated by subtracting pre-test reading from the reading obtained during hand immersion state. The subjects having ΔSBP < 14 mmHg and ΔDBP < 10mmHg were labelled as normo-reactors and ΔSBP ≥14mmHg and ΔDBP ≥ 10mmHg were labelled as hyper-reactors. There results are expressed as the percentages.

Results

A total of 14 subjects were recruited in the study (7 subjects were in the first trimester and another 7 were in the second trimester). The results are summarised in the Table 1.

The 51.7 percent of the subjects during first trimester turned out to be the hyper- reactors while in second trimester this was true for the 71.4 percent of the subjects.

Table 1:

Trimester	Age (years)	Resting Blood Pressure (mm Hg)		Blood pressure after 1 min of immersion of hand in cold water (4-5° C) (mm Hg)		Change in blood pressure (mm Hg)		Hyper-reactors (percent)	Normo-reactors (percent)
		Systolic	Diastolic	Systolic	Diastolic	Systolic	Diastolic		
I (n= 7)	34.6 ± 4.2	109.7± 5.3	72.5± 2.2	126.0±10.3	85.7±4.2	16.2±6.4	13.1±4.4	57.1	42.9
II (n= 7)	35.2 ± 3.7	106.3±3.2	71.6±1.5	123.3±5.7	83.0±2.0	17±3.2	11.3±2.7	71.4	28.6

Discussion

As observed in the study the resting blood pressure in both trimesters were within normal range and there is increase in both systolic and diastolic blood pressure in the subjects during cold pressor test, which is in accordance to the study carried out by Woisetschlager C et al [9] who evaluated 123 pregnant women between 16th to 20th week of gestation for increased vascular activity detected prior to clinical

manifestation of preeclampsia. and concluded that during the cold pressor test systolic as well as diastolic blood pressure increased significantly and was more pronounced in women developing preeclampsia as compared with healthy pregnant women.

Conclusion

The study carried out by Woisetschlager C et al included the subjects between 16th to 20th week of gestation but preliminary data of our study reveals that the subjects even in the first trimester showed increased blood pressure reactivity, thus it is hypothesised that assessment of sympathetic vascular reactivity reflected as blood pressure reactivity from early pregnancy may be a useful indicator for development of pregnancy induced hypertension and preeclampsia in later pregnancy and further studies are needed in this regard.

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