



STUDY OF HEART RATE VARIABILITY (TIME DOMAIN ANALYSIS) IN 1ST TRIMESTER OF NORMAL PREGNANT WOMEN AND PREGNANT WOMEN WITH RISK FACTORS FOR PIH IN WESTERN RAJASTHAN

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ABSTRACT **INTRODUCTION:** Pregnancy-induced hypertension (PIH) is a form of high blood pressure in pregnancy. It occurs in about 7 to 10 percent of all pregnancies. It is a disorder characterized by development of hypertension to the extent of 140/90 mm Hg or more. The main objective of our study was to compare the maternal time domain indices of Heart rate variability (HRV) changes between normal pregnant women and women with risk factors for PIH in their 1st trimester.

METHODS: Two hundred twenty subjects each (220 of normotensive pregnant women i.e., control group and 220 of pregnant women with risk factor for PIH i.e., study group) of 1st trimester of gestation were recruited from the obstetrics & gynecology department of Umaid hospital, associated with Dr. S. N. Medical College, Jodhpur, Rajasthan. Physical examination was done and anthropometric measurement like height & weight were taken. The collected data was statistically analyzed using HRV analysis software.

RESULTS: Significant difference in body mass index was observed between the two groups. Values of all the components of time domain analysis of HRV were significantly decreased except heart rate which was significantly increased among the pregnant women with risk factor for PIH than normal pregnant women.

CONCLUSION: The present study indicates that the BMI increases significantly in pregnant women with risk factor for PIH compared to normal pregnant women. The highly significant (HS) ($p < 0.000$) increase in the HR (beat/min), and highly significant (HS) ($p < 0.000$) decrease in SDNN (ms), RMSSD (ms), NN50 & PNN50% of pregnant women with risk factors for PIH was observed than normal pregnant women this indicate that parasympathetic tone was decreased in 1st trimester of pregnant women with risk factor for PIH. Vagal withdrawal and sympathetic exaggeration may be the possible cause of PIH in pregnant women in later part of their pregnancy.

KEYWORDS : PIH, Heart Rate Variability, pregnancy, autonomic nervous system

INTRODUCTION:

The Pregnancy Induced Hypertension is most common cause of maternal and prenatal morbidity and mortality during pregnancy⁽¹⁾. High blood pressure is an indication of an underlying pathology, which can be pre-existing or appears firstly during pregnancy⁽²⁾. If hypertension occurs for the first time during pregnancy then it's called Pregnancy Induced Hypertension (PIH). Pregnant women are at high risk of developing heart attack, cardiac failure, cerebrovascular accidents and renal failure due to severe hypertension during pregnancy.⁽³⁾ About 8-10% of the PIH incidence were reported among pregnant women in India. Previous studies also shows, the prevalence of PIH was 7.8% in population of India out of which 5.4% is of preeclampsia

The exact etiology of PIH is not known but low circulating volume and high vascular resistance is well established characteristics of this disease.⁽⁴⁻⁶⁾

Among many physiological changes occurring during pregnancy cardiovascular changes are very important.⁽⁷⁾ Autonomic nervous system influences these changes. So the study of ANS during pregnancy plays a significant role in the interpretation of vital information which may be helpful to deal with Pregnancy Induced Hypertension (PIH) or Preeclampsia⁽⁸⁾. Heart Rate Variability (HRV) analysis test can be used to evaluate changes in ANS during different pathophysiological conditions.

Time domain analysis of heart rate variability's (HRV) is a sophisticated, noninvasive tool for the detection of ANS regulation of the heart. In the field of Obstetrics & Gynecology, HRV is especially suitable for pregnant women because it is virtually noninvasive and produces the least stress on the mother and the infant.⁽¹¹⁾

High HRV is a sign of good adaptation indicating the efficient functioning of ANS. Conversely, low HRV signifies inadequate adaptation of the ANS, indicating physiological malfunction.^(10,11)

This study was conducted to compare the maternal time domain HRV

changes between normal pregnant women and pregnant women with risk factors for PIH.

MATERIAL & METHOD:

The present study was conducted in the Upgraded department of Physiology in Dr. S. N. medical college and hospitals, Jodhpur. Subjects (control group and study group) were recruited from the out-patient unit of the Obstetrics and Gynecology Department of UMAID hospital associated with Dr. S. N. Medical College.

Before starting study all ethical consideration for the subjects were taken in accounts and written permission was obtained from institutional ethical committee. A written consent was obtained from each subject. Sample of the 440 women (220 normal pregnant women and 220 pregnant women with risk factor for PIH) were collected during the October 2019 to December 2019.

Subjects of study group included pregnant women who had risk factors for PIH so inclusion criteria for the study group included established risk factors for PIH such as:

1. family history of preeclampsia,
2. preeclampsia in previous pregnancy,
3. extremes of reproductive age, and
4. BMI ≥ 30 .

Subjects of control group included pregnant women who had none of above mentioned risk factors for PIH. All the subjects were examined and detailed personal history was taken with reference to smoking, alcohol intake, family history of hypertension, socioeconomic status, place of residence etc. All subjects had to fill a proforma. Physical examination was done and anthropometric measurements like height and weight were taken and BMI was calculated.

The subject was advised to take complete bed rest in supine position for 10 minutes in a cool and calm environment and not to take and perform physical or mental activity. The recording of short term HRV was done according to recommendation of the task force. Following 10 minutes of supine rest in Polygraph laboratory of physiology

department which was established in OPD of Obs. & Gyne. Department of UMAID hospital, all leads of HRV was placed over the subject in requisite position. Lead II of ECG was recorded for 5 minutes during supine rest using Physio Pac Digital Polygraph- Physiograph PL-2008, Medicaid 6 channel Systems, Chandigarh.

The data was transferred from Medicaid machine to window based computer with HRV analysis software. Time domain indices such as mean Heart Rate, R-R interval, standard deviation of normal to normal intervals (SDNN) and square root of the mean square differences of successive normal to normal intervals (RMSSD), NN50%, and PNN50% of HRV were calculated.

Statistical analysis of data:

SPSS version 13 (SPSS Software Inc., Chicago, IL, USA) was used for statistical analysis. All data were expressed as mean ± SD. We used Student's unpaired t-test for the level of significance between the two groups.

RESULT:

Table 1: The comparison of the anthropometric parameters between normal pregnant women and pregnant women with risk factors for PIH.

Anthropometric measurement	1 st trimester of Normal pregnant women (control group)	1 st trimester of Pregnant women with risk factor for PIH (study group)	Normal v/s PIH risk factors women
	Mean±S.D	Mean±S.D	P value
Weight	50.72±6.49	67.55±11.7	<0.000
Height	156.49±6.12	158.23±6.2	<0.000
BMI	20.67±2.004	26.98±4.43	<0.000↑

The data presented are Mean±S.D. P value<0.01 was considered statistically highly significant.

Graph 1

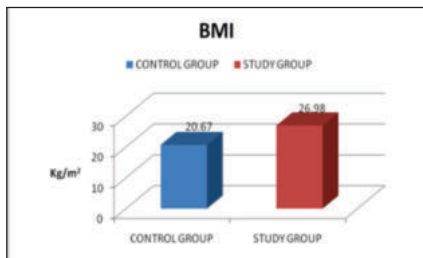
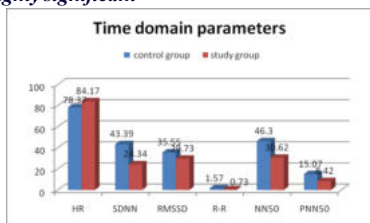


Table 1 and Graph 1 are showing the comparison of BMI (Kg/m²) parameters between the normotensive pregnant women and pregnant women with risk factors for PIH in their 1st trimester. The result shows highly significant (HS) (p<0.000) increase in the BMI of the pregnant women with risk factors for PIH.

Table 2: Time domain parameters between normal pregnant women and pregnant women with risk factors for PIH.

Time domain analysis	1 st trimester of Normal pregnant women (control group)	1 st trimester of Pregnant women with risk factor for PIH (study group)	Normal v/s PIH risk factors women
	Mean±S.D	Mean±S.D	P value
HR	78.37±2.85	84.17±5.90	<0.000↑
SDNN	43.39±20.32	24.34±4.93	<0.000↓
RMSSD	35.55±20.94	29.73±3.74	<0.000↓
R-R	1.57±8.05	0.73±0.05	<0.122↓
NN50	46.30±7.68	30.62±3.97	<0.000↓
PNN50	15.07±3.20	8.42±2.61	<0.000↓

The data presented are Mean±S.D. P value<0.01 was considered statistically highly significant



Graph 2

Table 2 and Graph 2 are showing the comparison of HR (beat/min), SDNN (ms), RMSSD (ms), R-R interval (ms) NN50 & PNN50% between the normal pregnant women and pregnant women with risk factors for PIH in their 1st trimester. The result shows the highly significant (HS) (p<0.000) increase in the HR (beat/min), and highly significant (HS) p<0.000 decrease in SDNN (ms), RMSSD (ms), R-R interval (ms) NN50 & PNN50% of pregnant women with risk factors for PIH.

DISCUSSION:

In the present study, the BMI of study group was significantly higher than control group (normal pregnant women) and towards the obese category. This suggested that there is increase in sympathetic activity in study group with risk factor for PIH. In Time domain analysis of heart rate variability six components were recorded i.e, Heart Rate, R-R interval, Standard deviation of normal to normal intervals (SDNN), and Square root of the mean squared differences of successive normal to normal intervals (RMSSD), NN50% and PNN50%. These indices chiefly show the parasympathetic activity. Significant increase in HR and decrease in all other indices was observed in pregnant women with risk factor for PIH than normal pregnant women. This indicates that parasympathetic tone was decreased during PIH. These indices reflect vagal modulation of heart rate and so we can say that contribution of vagal inhibition was more than sympathetic activation.

Same results were obtained by the study of Chaswal M. et al. (2018) (12), Hossen (2013) (13) Khan et al. (2014) (14), G. K. Pal et al (2011) (15), Shyma et al (2008) (16) and Yang et al (2000) (17). The changes occurs in preeclampsia is not fully understood but few studies observed that some biologically active factors like cytokines or reactive oxygen species from placenta which inhibit vascular relaxation pathway or facilitates vascular smooth muscle contraction, may be responsible for hypertension in pregnancy. These released peripherally and cross the blood-brain barrier and manipulate activities of various brain centers and their assessment may be helpful for further research. Although no intervention has yet proven effective for the prevention of PIH, early identification of women at risk for PIH may improve maternal and perinatal outcome. Screening for PIH is believed to be most relevant during the first trimester because preventive interventions (such as anti-platelet agents, calcium and antioxidants) are more likely to be effective if initiated early in pregnancy when pathogenic mechanisms may be modified. Further confirmation of the risk of future PIH based on HRV may enable closer prenatal monitoring, earlier diagnosis and prompt and appropriate management.

SUMMARY AND CONCLUSION:

The present study conducted with the objective to compare maternal HRV changes (Time domain analysis) between normal pregnant women & pregnant women with risk factor for PIH. The time domain analysis of heart rate variability proved as a good tool in the study of preeclampsia. Significant decrease in the component of time domain indices was observed except heart rate which was increased in the pregnant women with risk factor for PIH than normal pregnant women this indicates that parasympathetic tone was decreased in study group. Our study on time domain analysis suggested that vagal withdrawal and sympathetic exaggeration may be the possible cause of PIH in pregnant women. Our study could have been better if this study would be conducted in different trimester of pregnancy. Further this study could be better if we estimate the levels of placental factors cytokines and reactive oxygen species) in both the groups along with the level of proteinuria.

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