Waist circumference,BMI,Lipid profile between 6-16 weeks of pregnancy as predictors of Gestational hypertension & Pre-eclampsia

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ABSTRACT *Hypertensive disorders complicate almost 10% of pregnancies.We are still in search of ideal test for early detection and prevention of pre-eclampsia .This was an observational prospective study carried out in a tertiary care teaching institute during Aug 2010 to July 2012 to explore role of waist circumference,body mass index and serum levels of lipids in early pregnancy in prediction of gestational hypertension and pre-eclampsia.In this study, 150 women between 6-16 weeks with singleton pregnancy were recruited randomly and followed up in antenatal clinic till delivery 17 out of 150 developed Hypertensive disorder during pregnancy,Statistical analysis was done by applying unpaired 't' test,Chi square test & Fischer exact test.We found a very encouraging role of anthropometric and lipid profile parametres in prediction of hypertension in pregnancy.*

Introduction:

Hypertension in pregnancy is a major cause of maternal and perinatal morbidity and mortality. It complicates almost 10% of all pregnancies with higher incidence in young and nulliparous women1. Thus its prevention would have significant impact on maternal and perinatal outcome. The signs and symptoms of preeclampsia are usually apparent at a relatively late stage in pregnancy (late second and third trimester). However, the disorder results from abnormal interaction between fetal and maternal tissues much earlier (8-18 weeks).

Many unsuccessful studies have explored more than 200 possible markers for early detection of preeclampsia. Although numerous tests of clinical, biophysical and biochemical in nature have been proposed ,their results are inconsistent and contradictory, with most deemed unreliable or unsuitable for routine use in clinical practice2-6.

Therefore search for an adequate method for the screening of gestational hypertension and preeclampsia with high sensitivity and feasibility is still a priority. Antenatal waist circumference and serum level of lipids i.e. serum triglycerides and cholesterol have shown promising result for predication of gestational hypertension and preeclampsia in recent literature.

There is only one study correlating between waist circumference and development of gestational hypertension and preeclampsia later in pregnancy while there are many studies correlating body mass index and preeclampsia7-9.

Naveed et al (2001) showed that pregnant females with waist circumference greater than 80 cm were at high risk of developing gestational hypertension and preeclampsia10-11.

Correlation between level of lipids and gestational hypertension and preeclampsia has also been suggested. In preeclampsia, the increase in triglyceride levels is predicted to be well above the physiological elevation that occurs during normal pregnancy12-14. If elevated serum lipid in preeclampsia is associated with endothelial dysfunction, the increase might already be present in the first trimester14. To prove this hypothesis this study endeavors to analyze the level of serum triglyceride and cholesterol in early pregnancy as predictors of gestational hypertension and preeclampsia15.

AIM AND OBJECTIVES

- To evaluate the role of early pregnancy waist circumference and body mass index as predictors of gestational hypertension and preeclampsia.
- To estimate early pregnancy serum lipid level and correlate it with gestational hypertension and preeclampsia.
- To identify and reappraise other known risk factors of gestational hypertension and preeclampsia.

MATERIAL AND METHODS:

The present observational prospective study comprised 150 antenatal women who were outpatients as well as inpatients of antenatal ward and clinic of Obstetrics and Gynecology Department of Bharati Vidyapeeth Medical College and Hospital, Pune(Maharashtra) during the period Aug 2010 to July 2012.

INCLUSION CRITERIA:

1) Singleton pregnancy
2) Gestational age between 6-16 weeks.
3) Blood pressure reading systolic less than 140 mm Hg & diastolic less than 90 mm Hg
4) Willing to follow up & deliver in Bharati Hospital

EXCLUSION CRITERIA:

1) Multiple & molar pregnancy
2) Chronic diseases (chronic hypertension, diabetes mellitus, severe anaemia, Grade III & Grade IV heart disease, renal disease)
3) Known case of Anti Phospholipid syndrome
4) Any diagnosed case of congenital malformation
5) Smokers

All patients at the time of recruitment were subjected to:

I. Detailed clinical history
II. Clinical Examination
- Waist circumference: It was measured in cm midway between the lowest rib and liliac crest at the end of gentle exhalation.
- Hip circumference: It was measured in cm at the maxi-

mum width over the buttocks at the level of greater trochanter.
- Height: Height was measured in cm with the patient standing barefoot against a wall marked with a vertical scale.
- Weight: Weight was measured in kg with weighing machine with patient having light clothes.

Following ratios were calculated
1. Body Mass Index – It will be calculated as weight (kg) / height(m.)2
2. Waist to Height Ratio
3. Waist to Hip Ratio

III. Biochemical Investigation :
After overnight fast of 12 hours, blood samples was collected for
- Serum Cholesterol – By using enzymatic (cholesterol esterase) method
- Triglyceride – By using enzymatic (lipoprotein lipase) method
- HDL Cholesterol – By precipitation with phosphotungstate/Mg2+ method and cholesterol in supernatant will be determined as per serum-cholesterol.
- VLDL- was calculated as Triglyceride/5
- LDL- by Friedwald formula: total cholesterol – (HDL-C+VLDL-C) Lipoprotein (a) was determined in some cases.

All patients were followed thereafter in antenatal clinic till delivery. The number of patients developing gestational hypertension and preeclampsia were noted.

Gestational Hypertension:
Defined as blood pressure > 140/90 mmHg for the first time in pregnancy after 20 weeks of gestation, with no proteinuria.

PREECLAMPSIA:
Defined as blood pressure > 140/90 mm Hg after 20 weeks gestation and proteinuria > 300 mg in 24 hours or > 1 + dipstick.

SAMPLE SIZE: 150 cases were included in the study within the period of two years (August 2010-July 2012).

OBSERVATIONS AND RESULT:
This study included 150 patients. These cases were studied prospectively and following observations were recorded.

Table 1: Percentile distribution in study subjects (n=150)

	10th percentile	90th percentile
BMI	17.90	22.60
Waist circumference	65.63	76.77
Waist Hip Ratio	0.75	0.84
Waist-Height Ratio	0.42	0.52
Cholesterol	142.51	182.48
Triglycerides	68.4	112.95
HDL	36.2	53.29
LDL	82.4	114.39
VLDL	13.4	23.39

Conclusion:Values between 10th percentile and 90th percentile were considered to be falling in normal range while values above 90th percentile were considered to be indicators of risk.

Table 2: Difference in Normal Cut-off values for anthropometric and lipid levels and 90th percentile values in present study16

Parameter	90th percentile cut-off values in present study	Normal Reference cut-off values
BMI (kg/m2)	22.60	>25.0

Waist circumference (cm)	76.77	>88 cm
Waist Hip Ratio	0.84	0.81
Waist-Height Ratio	0.52	0.52
Cholesterol (mg/dl)	182.48	>200
Triglycerides(mg/dl)	112.95	>150
HDL(mg/dl)	53.29	<40
LDL(mg/dl)	114.39	>100
VLDL(mg/dl)	23.39	>40

Table 3: Incidence of Gestational Hypertension and Preeclampsia

SN	Group	Status	No. of women	Percentage
1.	I	Normotensive	133	88.7
2.	II	Hypertensive	17	11.3
	IIa	Gestational hypertension	12	8.0
	IIb	Pre-eclampsia	5	3.3

Conclusion: shows that majority of women (n=133; 88.67%) of women included in the study were normotensive (Group I) and rest of the women (n=17; 11.33%) were hypertensive (Group II) and percentage of women suffering from gestational hypertension was 8.0% (Group IIa) while that of women with pre-eclampsia was 3.33% (Group IIb).

Table 4: Comparison of Anthropometric variables between normotensive and hypertensive women included in the study

Anthropometric variables	Group I (n=133)		Group II (n=17)		Statistical significance	
	Mean	Std. deviation	Mean	Std. deviation	't' value	'p' value
Body mass index	19.77	1.55	24.38	2.65	10.501	<0.001
Waist-Height Ratio	0.45	0.03	0.55	0.07	11.037	<0.001
Waist-Hip ratio	0.79	0.03	0.85	0.03	7.345	<0.001
Waist circumference	69.43	3.95	82.27	6.96	11.382	<0.001

Conclusion: Anthropometric variables such as Body mass index, Waist-Height ratio, Waist-Hip ratio, and waist circumference were found to be significantly higher in Group II as compared to Group I (p<0.001 for all variables).

Table 5: Comparison of Biochemical parameters between normotensive and hypertensive women included in the study

Biochemical variables	Group I (n=133)		Group II (n=17)		Statistical significance	
	Mean	Std. deviation	Mean	Std. deviation	't' value	'p' value
Cholesterol	157.61	13.67	188.16	15.15	8.573	<0.001
Triglycerides	86.79	14.92	130.18	34.49	9.314	<0.001
HDL	46.11	5.41	38.29	6.84	5.437	<0.001
VLDL	17.97	3.39	26.66	7.15	8.499	<0.001
LDL	94.62	11.88	115.04	19.41	6.142	<0.001

Conclusion: Above comparison shows that significantly higher levels of Cholesterol, triglycerides, VLDL and LDL were found in Group II than in Group I (p<0.001) while significantly higher levels of HDL were found in Group I subjects as compared with Group II subjects (p<0.001).

Table 6: Comparison of various parameters as risk factor

Risk factor	Sensitivity	Specificity	Positive predictive value	Negative predictive value	Relative risk
BMI >22.60	76.5	97.7	81.3	97.0	27.22
Waist circumference >76.77 cm	76.5	98.5	86.7	97.0	29.25
Waist hip ratio >0.84	70.6	94.0	60.0	96.2	15.60
Waist height ratio >0.52	64.7	99.2	91.7	95.7	21.08
Cholesterol level >182.48	70.6	97.7	80.0	96.3	21.60
Triglyceride levels >112.95	70.6	97.7	80.0	96.3	21.60
HDL level <36.2	52.9	94.7	56.3	94.0	9.422
LDL level >114.39	47.1	94.7	53.3	93.3	8.000
VLDL level >23.39	70.6	97.7	80.0	96.3	21.60

DISCUSSION AND CONCLUSION:

- A total of 11.3% of patients developed gestational hypertension (n=12; 8.0%) or preeclampsia (n=5; 3.3%) in this study.

- In present study, all the anthropometric parameters (body mass index, waist-height ratio, waist-hip ratio and waist circumference) showed a significant association with development of hypertension during pregnancy in general as well as with gestational hypertension and preeclampsia independently.

- Table 2 findings suggest that the reference ranges defined for normal adult population need a relook and should be amended in accordance. Snehlatha et al. (2003)16 have also recommended a population specific redefinition of anthropometric measurements and have established that the normal universally defined range of risk parameters does not apply to the Indian population without a change.

- Among different anthropometric parameters, waist circumference and BMI showed maximum relative risk (RR=29.25 and 27.22 respectively) on taking the criteria of 90th percentile cut-off values of BMI as >22.60 and that of waist circumference to be >76.77. The sensitivity and specificity of these cut-off values were found to be 76.5% and 98.5% for waist circumference and 76.5% and 97.7% for BMI.

- In present study, Triglyceride, Cholesterol, LDL and VLDL levels showed an increased risk of hypertension while HDL showed a decreased risk of hypertension.

- The relative risk of hypertension using the criteria of 90th percentile values as the cut-off showed maximum risk of hypertensive pregnancy to be associated with Cholesterol, Triglyceride and VLDL levels (RR=21.60), though LDL and HDL levels also showed a significant association but relative risk of their 90th percentile cut-off values was much lower (8.00 and 9.42 respectively).

- Among different lipid parameters, Cholesterol, triglyceride and VLDL levels showed a sensitivity of 70.6% and a specificity of 97.7% for designated 90th percentile cut-off values.

- However, the sensitivity and specificity of designated 90th percentile cut-off values of HDL and LDL levels was 52.9% and 94.7% and 47.1% and 94.7% respectively.

- The findings in present study showed high efficiency of simple to carry out anthropometric measurements with BMI and waist circumference to be >75% sensitive and >95% specific, thus showing possibility of a self-assessment of hypertension risk during pregnancy and in turn importance of controlling weight before planning a pregnancy. Given the limitations of sample size and duration of study, the present study should be viewed as a preliminary trend which needs further collaboration surpassing these limitations.

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