Assessment of Serum βhCG, Lipid Profile and Uric Acid Levels in Early Second Trimester as Predictors of Pregnancy Induced Hypertension

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ABSTRACT

Background: Pregnancy induced hypertension is one of commonest complication affecting pregnant females with serious implications on both maternal and fetal health. Our aim is to assess the importance of measuring serum βhCG, lipid profile and uric acid levels in early second trimester of at-risk pregnant females

Methods: A prospective study was conducted on 55 pregnant females visiting antenatal outpatient department of the Obstetrics and Gynaecology and department of pathology of MGH Hospital, RK Puram, New Delhi from January 2011 to December 2012. The study group included 25 at risk pregnant females and 30 females with normal pregnancy

Results: In study group, the mean systolic and diastolic group was found to be higher than the healthy controls. The serum βhCG, lipid profile and uric acid levels were also found on higher side in the hypertensive group as compared to the normotensive pregnant females.

Conclusion: Evaluation of maternal βhCG, lipid profile and uric acid can serve as reliable predictors of pregnancy induced hypertension. Early identification of at-risk women may help in taking timely preventive and curative management to prevent or halt pregnancy related complications.

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Introduction

Pregnancy is a physiological process but needs strict monitoring throughout gestational period to circumvent perilouscomplications like pregnancy induced hypertension (PIH), gestational diabetes etc. Pregnancy induced hypertension is a disease influencing 5–10 % of all pregnant women.[1] Pregnancy induced hypertension, defined as hypertension after 20 weeks of pregnancy in a woman with edema and proteinuria without previous history of hypertension.[2] Pregnancy induced hypertension is one of the existing medical illness which is responsible for majority of pregnancy related morbidity and mortality.[3]

Recently, multiple hypothesis have been postulated to understand the complex etiopathogenesis which enlists (i) placental ischemia, (ii) altered endothelial cell function, possibly secondary to altered lipid metabolism (iii) immune maladaptation and (iv) genetic imprinting.[4] PIH is considered to be a trophoblastic disorder and the supporting evidence comes from the fact that these patients may suffer from either hyperplacentosis or an abnormal placentation.[5]

In PIH, there is mid-trimester surge of βhCGdue to overwhelming secretory response of the immunologically modified trophoblast.[6] Also, there is 2-3 times rise in serum triglyceride concentration which are likely to get accumulated in the uterine spiral arteries contributing to endothelial activation and damage.[2,7] Serum uric acid is known to decrease in early pregnancy but patients presenting with PIH shows elevated levels even in third trimester in association with relatively less urate excretion.[8]

Uniqueness of this paper is reflected by comparative study of serumβhCG, lipid profile and uric acid in pregnant females for early diagnosis, timely intervention and close surveillance of pregnancy induced hypertension. To best of our knowledge this is the first study based on assessment of triple biochemical parameters in an effort to avert the dreadful complications of pregnancy induced hypertension.

Material and Methods

This was a prospective and observational study, conducted on 25 patients and 30 healthy age matched controls. The study population includes pregnant females visiting antenatal outpatient department of the Obstetrics and Gynaecology of MGH Hospital, RK Puram, New Delhi from January 2011 to December 2012.

All patients and controls were investigated for serum βhCG, lipid profile and uric acid in beginning of second trimester (14–20 weeks). 3 ml of blood was collected after 12 h of fasting in plain vacutainer under aseptic precautions. The blood was allowed to stand undisturbed for half-an hour and followed by centrifugation at 2500 rpm for 15 minutes. The comparative study of serum βhCG, lipid profile and uric acid were done between the normotensive controls (group I) and pregnancy-induced hypertension patients (group II).

Patients of hypertension diagnosed before 20 weeks of gestation, diabetes mellitus, molar pregnancy and any other chronic illness were excluded from the study.

Serum βhCG was determined by ELISA (enzyme linked immunoassay) using AIA 360 fully automated Tosho immunoassay analyser. Serum lipid profile and uric acid were performed on fully automated biochemistry analyser (Logotech) using immunofluorescence method. Total lipids were calculated as 250 + serum triglyceride + serum cholesterol. VLDL was calculated as serum triglyceride divided by 5.

Statistical Analysis: Mean ± SD of all the parameters of interest were calculated for PIH and for normal separately and difference of means between the two groups was tested by t-test.

Results

In the study group, 12/25 pregnant females were in the age range of 25-29 years constituting 48% of the population, similarly in the control group majority of population were falling in the same age group comprising of 33.33% of the population (Table 1& figure 1)

The result illustrates that 16/25 females of study group and 14/30 females of the control group were primigravidas constituting 54.54% of the total population. On the other hand, 25/55 females were multigravidas constituting 45.45% of the total population (Table 2 & figure 2)

Blood pressure was recorded for all patients at each visit. Mean Systolic BP and diastolic BP of the study group was 136 mm of Hg and 85.42 mm of Hg and was higher as compared to control group which was 110.4 mm of Hg and 72.0 mm of Hg respectively. At the time of delivery, mean systolic and diastolic BP was higher in the study group in comparison to healthy controls (p<0.05). Blood pressure returned to normal within one month after delivery (Table 3).

The levels of βhCG in the study group (41500) was comparatively higher than the control group (22500) which was statistically significant (p=0.0001). The serum cholesterol (218.4), LDL(136) and uric acid levels(6.3) were also noted to be higher in the study population as compared to normal population and was statistically significant (p<0.05). However, the triglycerides, HDL, VLDL values were not statistically significant (Table 4, figure 3& 4)

Table 1: Distribution of cases according to age

Age (years)	Study group (n=25)	%	Control group (n=30)	%
20-24	7	28	12	40
25-29	12	48	10	33.33
30-34	5	20	06	20
35-39	1	2	02	6.66

Table 2: Distribution of cases according to parity

Parity	Study group(n=25)	Control group(n=30)	Total cases(n=55)
G1	16	14	30
G2	06	10	16
G3	02	04	06
G4	01	02	03

Table 3: Comparison of systolic and diastolic blood pressure between study and control groups.

At 14-20 weeks			
Blood pressure (mm of Hg)	Study group (n=25) Mean ± SD	Control group(n=30) Mean ± SD	p Value
Diastolic BP	85.42 ± 5.75	72.0 ± 5.6	0.0001
Systolic BP	136 ± 5.42	110.4 ± 3.2	0.0001
At delivery			
Diastolic BP	92.4 ± 4.6	76.6 ± 4.6	0.0001
Systolic BP	141.2 ± 5.2	120.30 ± 1.9	0.0001

Table 4: Comparison of B-HCG and serum lipid profile between study and control groups

Variables	Study group (n=25) Mean±SD	Control group(n=30) Mean±SD	p Value
βhCG (mIU/ml)	41500 ± 14000	22500 ± 4500	0.0001
Cholesterol (mg/dl)	218.40 ± 40.29	188 ± 30.13	0.002
Triglycerides (mg/dl)	210 ± 57.3	185.5 ± 46.5	0.08
HDL (mg/dl)	45.38 ± 22.74	49 ± 17.8	0.51
VLDL (mg/dl)	48.18 ± 18.5	45.04 ± 21	0.56
LDL (mg/dl)	136 ± 46.2	107 ± 16.3	0.002
Uric acid (mg/dl)	6.3 ± 3.6	3.9 ± 2.2	0.003
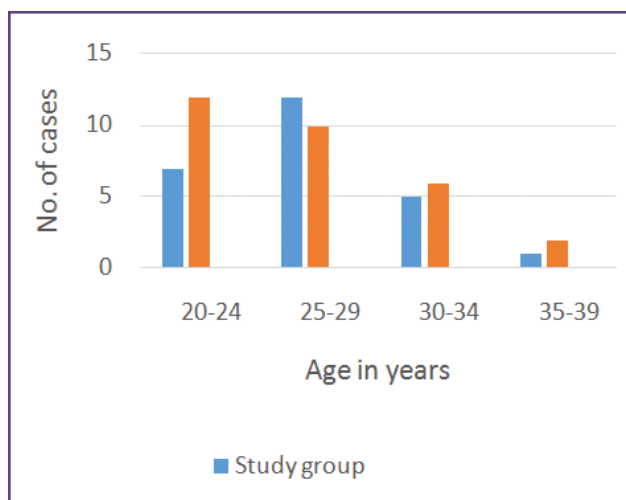
Fig. 1: Distribution of cases according to age
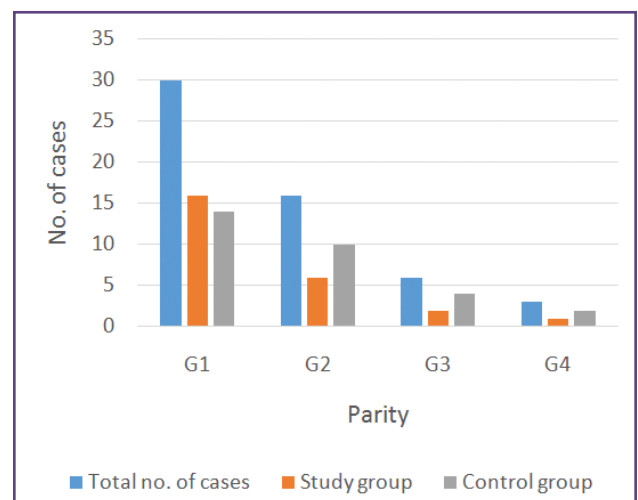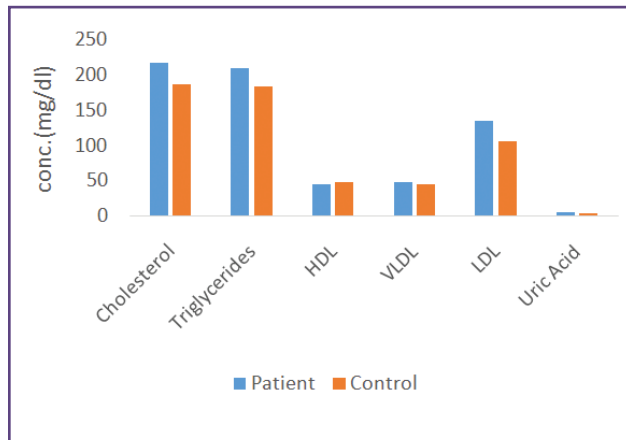

Fig. 2: Distribution of cases according to parity

Fig. 3: Comparsion of lipid profile and uric acid between patient and control group

Fig. 4: Comparsion of βhCG between patient and control group

Discussion

In our present study, we investigated the importance of βhCG, lipid profile and uric acid in pregnancy induced hypertension. This study included 55 pregnant females who visited antenatal OPD, 54.5% females were primigravidas and 50.9% were in the age range of 20-25 years with mean age of presentation of 23.5 years. The cases were categorized into study and control group and monitored throughout the gestational period and followed till the delivery and in postpartum period. The study group included 25 pregnant females who subsequently developed pregnancy induced hypertension and rest 30 females remained normotensivethroughout the pregnancy.

The main factor for dyslipidemia in PIH is hyperestrogenemic state as estrogen induces hepatic production of TGs through VLDL, this process is modulated by hyperinsulinism that starts in pregnancy.[9]The dyslipidemic profile seen in pre-eclamptic women is also attributed to dysregulation of the lipoprotein lipase.[10] Another important event in the pathogenesis of PIH is endothelial dysfunction which is secondary to generation of oxidative stress.[11]

In our present study, serum levels of TC, triglycerides andLDL were increased in the hypertensive group and were significantly increased while, the level of HDL, triglycerides and VLDL were not statistically significant. This discordance in the values of lipid profile of the study and control group may be attributed to the small sample size. Our findings were supported by similar other studies.

Lorentzen et al. concluded that higher serum-free fatty acids and triglyceride are noted before 20 weeks of gestation in women developing PIH.[12] Similar results were demonstrated by Cekmen et al. with higher plasma triglyceride and LDL levels and significantly lower HDL levels in PIH subjects than in control group.[13]Vidyabati et al. also concluded that total cholesterol; VLDL, and
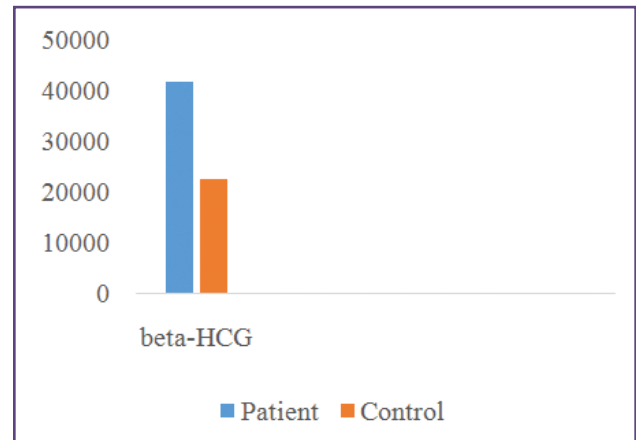
LDL in women who subsequently developed PIH were significantly higher than in normotensive patients.[14]

Our results showed that pregnant women having very high serum βhCG level around 45000 mIU/ml at the early second trimester developed PIH later in their pregnancy with p value of 0.0001 which is statistically significant. It is believed that increasedβhCG secretion may result as a consequence of abnormal placental invasion or placental immaturity. Some advocates that it may due to abnormal trophoblastic response to hypoxia and subsequent development of a hypersecretory state.[4]Exact pathogenesis remains unknown, but the supporting findings showed patients suffering from PIH had increased density of β-hCGpositive trophoblast along with an increased intensity of β-hCG immunostaining within the placental villi.[15]

During early pregnancy, the levels of uric acid are bound to decrease pertaining to increased renal perfusion and uricosuric effects of estrogen with a surge noticed in later half of the pregnancy. In contrast, the PIH patients show slightly higher serum uric acid levels even during the first trimester due to relative reduction in urinary urate excretion.[16] The mechanism of uric acid mediated damage to maternal vasculature resulting in failed placental bed formation is due to interference in trophoblast invasion. This consequently leads to ischemia reperfusion injury to the placenta and oxidative stress.[17]

There are various factors responsible for increased uric acid in preeclampsia; abnormal renal function, increased tissue breakdown, acidosis and increased activity of the enzyme xanthine oxidase/dehydrogenase[18].Our findings showed elevation of serum uric acid levels in early pregnancy of pre-ecclamptic females. Similar results were concluded by Bellomo et al in a study conducted on 163 pregnant females in which approximately 45% females developed

PIH. It was noticed that increased serum uric acid levels confers an 8–9 fold risk for PIH and also a 1.6–1.7-fold risk for small for gestational age (SGA) infants.[19]

Thus, a triple assessment of maternal lipid profile, βhCG and uric acid levels in mid-trimester pregnancy helps in early recognition and better management of patients at risk of pregnancy-induced hypertension.

Conclusion

Maternal dyslipidemia along with elevated maternal serum βhCG and uric acid at second trimester are very good non-invasive predictors of PIH which may assist in timely intervention to prevent both maternal and fetal complications.

Competing Interests
None declared

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