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Original Research Article

The role of serum beta-human chorionic gonadotropin as a predictor for pregnancy induced hypertension in 12-20 weeks of pregnancy

Shakun Singh, Swati Gupta*, Rachna Chaudhary, Vandana Dhama

Department of Obstetrics and Gynaecology, LLRM Medical College, Meerut, Uttar Pradesh, India

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***Correspondence:**
Dr. Swati Gupta,
E-mail: shyamradha9927@gmail.com

ABSTRACT

Background: Pregnancy-induced hypertension occurs in approximately 3 to 5% of pregnancies and is still a major cause of both fetal and maternal morbidity and mortality worldwide. Pre-eclampsia is risk factor for stillbirth, intrauterine growth restriction (IUGR), low birth weight (LBW), preterm delivery, respiratory distress syndrome, and admission to neonatal intensive care unit. Overall, the incidence of preeclampsia ranges from 5 to 15% in India. This study conducted to assess the predictive value of raised beta-human chorionic gonadotropin (β-hCG) levels in development of pregnancy-induced hypertension in antenatal women and follow up the risk patients and reduce both maternal and perinatal morbidity and mortality.
Methods: The present study was conducted in the department of obstetrics and gynaecology, L.L.R.M Medical College and associated SVBP Hospital, Meerut during the period of January 2021 to December 2021 on 400 antenatal women with 12 to 20 weeks of gestation. Estimation of serum beta hCG level was done by enzyme linked fluorescence immunoassay. The cases were followed up in antenatal clinics, 4 weekly till 28 weeks, fortnightly up to 34 weeks and thereafter weekly till delivery for the development of PIH.
Results: From the study it was found that women with elevated beta hCG values in 12-20 weeks were at increased risk of developing PIH. The sensitivity of β-hCG for development of PIH was found to be 90%. It was found that specificity, positive predictive value (PPV), negative predictive value (NPV) of β-hCG for development of PIH was 82%, 41.7%, 98.3% respectively. However, p value of β-hCG for development of PIH is 0.001 which is highly significant.
Conclusions: From this study we found that that measuring second trimester serum beta-hCG levels is a good predictor of pregnancy induced hypertension and showed association with elevated levels of beta hCG with development and severity of PIH, but sensitivity and positive predictive value of beta hCG are low in this study to be useful for mass screening marker on its own.

Keywords: Preeclampsia, Hypertensitive disorder of pregnancy, Beta hCG

INTRODUCTION

Hypertensive disorder of pregnancy is an enigmatic condition despite exhaustive research, and is associated with high maternal and perinatal mortality and morbidity. Pregnancy-induced hypertension occurs in approximately 3 to 5% of pregnancies and is still a major cause of both fetal and maternal morbidity and mortality worldwide.[1] Pre-eclampsia is risk factor for stillbirth, intrauterine growth restriction (IUGR), low birth weight (LBW), preterm delivery, respiratory distress syndrome, and admission to neonatal intensive care unit. Overall, the incidence of preeclampsia ranges from 5 to 15% in India.[2,3] Incidence in primigravidae is 10% and that in multigravidae is 5%. Human chorionic gonadotropin (hCG) is a pregnancy specific hormone produced by trophoblast cells, regulates progesterone production, implantation, uterine growth and immune cell function. HCG also regulates placental development, angiogenesis and vasculogenesis partially via effects on VEGFs. In PIH,

there is mid trimester surge of beta hCG levels due to overwhelming secretory response of immunologically modified trophoblasts.[2] Pathogenesis of preeclampsia is complicated and has not been fully elucidated. It is currently believed to result from a combination of immunologic, environmental, and genetic factors. These factors lead to the failure of normal trophoblastic invasion and remodeling of the uterine spiral arteries leading to impaired placentation. This has been considered as one of the initial events in the disease process.

Aims and objectives

The present study will be conducted in the department of obstetrics and gynaecology, L.L.R.M Medical College and associated SVBP Hospital, Meerut during the period of January 2021 to December 2021 with the following objectives and aims- to estimate serum β-hCG levels between 12 and 20 weeks of pregnancy and to assess the predictive value of raised β-HCG levels in development of pregnancy-induced hypertension in antenatal women; to correlate the maternal and neonatal outcome with levels of serum β-hCG in pregnancy induced hypertension; and to correlate the higher levels of beta HCG with increased severity of Pregnancy induced hypertension.

METHODS

The present study was conducted in the department of obstetrics and gynaecology, L.L.R.M Medical College and associated SVBP Hospital, Meerut during the period of January 2021 to December 2021 on 400 antenatal women with 12 to 20 weeks of gestation, primi/multigravida with singleton uncomplicated pregnancy, normotensive with gestational age determined by last menstrual period or by ultrasounds can and willing to participate in the study and deliver at the tertiary care center. Antenatal women with chronic hypertension, diabetes mellitus, congenital anomalies, multiple gestation, molar pregnancy were excluded from the study. Estimation of serum beta hCG level was done by enzyme linked fluorescence immunoassay. The cases were followed up in antenatal clinics, 4 weekly till 28 weeks, fortnightly up to 34 weeks and thereafter weekly till delivery for the development of PIH.

Gestational hypertension is defined as systolic blood pressure (SBP) of ≥140 mm Hg and/or diastolic blood pressure (DBP) of ≥90 mm Hg) at ≥20 weeks of gestation and recover ≤12 weeks after delivery. Preeclampsia is defined as hypertension with proteinuria (excretion of ≥300 mg protein per day) at ≥20 weeks of gestation and recovery ≤12 weeks after delivery. Superimposed preeclampsia is defined as: proteinuria at ≥20 weeks of gestation superimposed on chronic hypertension present at 20 weeks of gestation and /or before pregnancy, or the deterioration of hypertension and/or proteinuria at ≥20 weeks of gestation in patients with chronic hypertension with proteinuria at 20 weeks of gestation or GH occurring in renal disease only with proteinuria at 20 weeks of gestation and/or before pregnancy. Eclampsia is defined as the onset of seizures at ≥20 weeks of gestation without convulsion or secondary seizures.[4]

RESULTS

In Table 1, 400 normotensive patients at the time of booking, out of which 12.5% patients developed PIH, while 87.5% patients remained normotensive at the end of study.

Table 1: Distribution of patients who developed PIH.

Parameters	No. (n=400)	%
With PIH	50	12.5
Without PIH	350	87.5

Table 2: Distribution of patients according to severity of PIH development.

Parameters	No. (n=50)	%
Mild	23	46.0
Moderate	17	34.0
Severe	10	20.0

Table 3 shows that in patients whose β-hCG value is >50,000 mIU/ml developed PIH. It revealed that 96.7% of patients whose β-hCG value was >60,000 developed PIH. The association between β-hCG level and development of PIH was found to be significant.

It was found that participants who were having β-hCG level above 60,000 mIU/ml, majority of them were having severe PIH. The association between β-hCG level and development of PIH was found to be significant (Table 4).

It was found that participants who were having β-hCG level above 60,000 mIU/ml, majority of them had abnormal perinatal outcome. The association between β-hCG level and perinatal outcome was found to be significant (Table 5).

It was observed that participants who were having PIH had mean β-hCG of 59764.50±9425.80 mIU/ml whereas participants who were not having PIH had mean β-hCG of 36967.57±8026.05. The association between β-hCG and PIH was found to be significant (Table 6).

The sensitivity of PIH for development of PIH was found to be 90%. It was found that specificity, PPV, NPV of β-hCG for development of PIH was 82%, 41.7%, 98.3% respectively. However, p value of β-hCG for development of PIH is 0.001 which is highly significant (Table 7).

Table 3: Association of values of β-hCG among participants with development of PIH.

β-hCG	No. of patients	With PIH		Without PIH		P value[1]
		No.	%	No.	%	
<30,000	77	1	1.3	76	98.7	0.001*
30,000-40,000	142	0	0.0	142	100.0	
41,000-50,000	135	8	5.9	127	94.1	
51,000-60,000	16	12	75.0	4	25.0	
>60,000	30	29	96.7	1	3.3	

[1]Chi-square test, *Significant

Table 4: Association of values of β-hCG among participants with severity of PIH development.

β-hCG	No. of patients	Mild		Moderate		Severe		P value[1]
		No.	%	No.	%	No.	%	
<30,000	1	0	0.	0	0.0	1	100.0	<0.05
41,000-50,000	8	3	37.5	4	50.0	1	12.5	
51,000-60,000	12	5	41.7	5	41.7	2	16.7	
>60,000	29	15	51.7	8	27.6	6	20.7	

[1]Chi-square test

Table 5: Association of β-hCG with perinatal outcome among PIH patients.

β-hCG	No. of patients	Normal		Abnormal		P value[1]
		No.	%	No.	%	
<30,000	1	1	100.0	0	0.0	<0.005
41,000-50,000	8	6	75.0	2	25.0	
51,000-60,000	12	8	66.7	4	33.3	
>60,000	29	12	41.4	17	58.6	

[1]Chi-square test

Table 6: Comparison of values of β-hCG between participants with and without PIH.

Parameters	β-hCG
With PIH	59764.50±9425.80
Without PIH	36967.57±8026.05
P value[1]	0.0001*

[1]Unpaired t-test, *Significant

Table 7: Predictive value of β-hCG with in predicting development of PIH.

β-hCG cutoff	With PIH		Without PIH		Total	
	No.	%	No.	%	No.	%
>45,000	45	11.2	63	15.8	108	27.0
≤45,000	5	1.2	287	71.8	292	73.0
Total	50	12.5	350	87.5	400	100.0
Predictive values, %						
AUC, p value	0.94, 0.0001*					
Sensitivity	90.0					
Specificity	82.0					
PPV	41.7					
NPV	98.3					

[1]Chi-square test, *Significant

DISCUSSION

In this study 400 normotensive patients were taken at the time of booking, out of which 12.5% patients developed PIH, while 87.5% patients remained normotensive at the end of study. Out of all the patients who participated in this study 43.5% participants were primi gravida followed by 56.5% which were multigravida. Mean SBP of all patients

at the time of booking was 116.38+6.09 mm Hg and DBP was 74.39+6.89 mm Hg.

Total 50 patients who developed PIH in present study, 46% patients were having mild PIH, 34% patients were having moderate PIH and 20% patients were having severe PIH. The results were in accordance with Heena et al which reported that out of 250 patients who developed PIH, 51% were having mild, 32% were having moderate and 17% were having severe PIH.[5] The present study reported the association between β-hCG level and development of PIH and it was found to be significant with (p value 0.0001). It was found that participants who were having β-hCG level above 60,000 mIU/ml, majority of them were having severe PIH and association between β-hCG level and severity of development of PIH found to be significant with (p value of <0.05) . It was observed that participants who were having PIH had mean β-hCG level of 59764.50±9425.80 mIU/ml whereas participants who were not having PIH had value of mean β-hCG of 36967.57±8026.05 mIU/ml. The sensitivity of β-hCG for development of PIH was found to be 90%, specificity 82%, PPV of 41.7%, NPV of 98.3%. The area under curve is 0.94. In a study by Kaur, et al conducted on 200 cases of whom 22 (12.36%) cases developed PIH. 20 (83.33%) out of 22 cases with beta hCG levels >2MOM developed PIH against 2 (1.2%) cases out of 154 having beta hCG levels ≤2 MOM (p value <0.001). Also, higher levels of beta hCG are associated with increased severity of PIH. The difference was statistically significant (p value <0.01).[6] In a study by Sharma et al, 500 women were enrolled only 447 (89.4%) women were completely followed till term. Out of 447 cases which were final evaluated, 387 cases (86.57%) had beta-hCG levels <2MOM, whereas 60 cases (13.48%) had values >2 MOM. Out of 387 cases with beta-hCG levels <2 MOM, only 6 cases (1.56%) developed pregnancy induced hypertension. The remaining cases, 381 (98.44%), were normotensive. The study concluded that measuring second trimester serum beta-hCG levels is a good predictor of pregnancy induced hypertension.[7] In present study, the increasing beta hCG levels showed direct association with severity of PIH. Similar results were shown in a study by Roiz-Hernandez et al in which author concluded positive correlation between beta HCG values and severity of PIH.[8]

CONCLUSION

From this study we found that that measuring second trimester serum beta-hCG levels is a good predictor of pregnancy induced hypertension and showed association with elevated levels of beta HCG with development and severity of PIH, but sensitivity and positive predictive value of beta hCG are low in this study to be useful for mass screening marker on its own. Therefore, it should be combined with other serum markers and ultrasound parametres like Doppler study of uterine vessels, which will help in improving its role as a screening tool.

Recommendations

Serum beta hCG should be combined with other serum markers and ultrasound parameters like Doppler study of uterine vessels, which will help in improving its role as a screening tool and follow up the risk patients and reduce both maternal and perinatal morbidity and mortality.

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