**Original Research Article**

# Serum β HCG as a predictor and potent marker for pregnancy induced hypertension

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## Abstract

**Background:** Hypertensive disorders are also responsible for perinatal mortality and morbidity. Pre-eclampsia is a risk factor for stillbirth, IUGR, LBW, Preterm delivery, Respiratory distress syndrome, and admission in the neonatal intensive care unit. Hypertensive disorders account for 8-10% of all preterm births.

**Aim of the study:** This study was conducted to predict gestational hypertension by using serum beta HCG and thereby to follow up the risk patients and to reduce both maternal and perinatal morbidity and mortality.

**Materials and methods:** A prospective study was done to determine the role of βHCG in 100 pregnant women in their second trimester (13-20) weeks, attending Tirunelveli medical college OPD. Duration of study was from March 2018- January 2019. Routine antenatal investigations were done. 5 ml of venous blood sample was collected and tests were carried out. Estimation of serum beta HCG level was done by enzyme-linked fluorescence immunoassay. In the antenatal clinic, the patients were followed up.

**Results:** From the study, it was found, women who have elevated βHCG values in 13-20 weeks were at increased risk of developing PIH. For any test to be used as screening test it should have good sensitivity, specificity, and positive predictive value. In this study, β HCG had Sensitivity – 71.4%, Specificity - 87.1%.

**Conclusion:** While comparing patients with normal BP and pre-eclampsia - βHCG values are elevated in patients with preeclampsia. The sensitivity and specificity of βHCG are very low to be

useful as a mass screening marker on its own and therefore it 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.

**Key words**

Preeclampsia, Hypertensive disorder of pregnancy, β HCG, Screening.

## Introduction

Pregnancy-induced hypertension (PIH) is a unique disease seen only in pregnancy affecting 12–15 % of all pregnant women. In spite of the improvement in maternal and neonatal care, PIH and its sequelae are a dreaded complication of pregnancy [1]. It is indeed a constant endeavor of obstetricians to identify the risk involved in pregnancy and if possible its prediction. If prediction becomes possible, prevention will follow naturally [2]. Several tests have been proposed but none has been accepted widely due to their low predictive value [3]. The abnormal placentation has been considered as one of the initial events in the disease process hypothesized that during mid-trimester, immunological changes occur in the trophoblasts, resulting in a secretory response, which is seen as a rise in the beta HCG levels [4]. Hypertensive disorders are also responsible for perinatal mortality and morbidity. Pre-eclampsia is a risk factor for stillbirth, IUGR, LBW, Preterm delivery, Respiratory distress syndrome, and admission in the neonatal intensive care unit. Hypertensive disorders account for 8-10% of all preterm births [5]. A variety of biochemical and biophysical markers have been proposed for predicting the development of preeclampsia in pregnancy. Chorionic villi are the one that is needed for the development of preeclampsia [6]. A fetus is not an important factor. Human chorionic gonadotropin is synthesized from syncytiotrophoblast in chorionic villi. The incomplete trophoblastic invasion that is the replacement of vascular endothelial and muscular linings by endovascular trophoblast to enlarge the vessel diameter is incomplete [7].

## Materials and methods

A prospective study was done to determine the role of β HCG in 100 pregnant women in their second trimester (13-20) weeks, attending Tirunelveli medical college OPD. Duration of study was from October 2018- January 2019. Routine antenatal investigations were done. 5 ml of venous blood sample was collected and tests were carried out. Estimation of serum beta HCG level was done by enzyme-linked fluorescence immunoassay. In the antenatal clinic, the patients were followed up.

**Inclusion criteria**

Pregnant women with

- Nonproteinuric.
- Normotensive.
- Primi/Multi gravida.
- Singleton
- Gestational age 13-20 weeks as determined by last menstrual period or ultrasound scan.

**Exclusion criteria**

- Chronic hypertension.
- Molar Pregnancy.
- Diabetes mellitus.
- Anomalous foetus.
- Multiple pregnancies.

All the women were subjected to detailed history regarding age, parity, past obstetric history, medical history, and family history. Height, weight, blood pressure was measured. A routine antenatal investigation was done. 5 ml of venous blood sample was collected and tests were carried out. Estimation of serum β HCG level was done by enzyme-linked fluorescence immunoassay. The cases were followed up in antenatal clinic and were examined 4 weekly till 28 weeks, fortnightly up to 34 weeks and thereafter weekly till delivery. At every visit,

blood pressure was recorded and urine was examined for albumin. PIH included gestational hypertension and preeclampsia. Gestational hypertension was defined as blood pressure 140/90 mmHg on two occasions at least 6 hours apart after 20 weeks of gestation. Preeclampsia was defined as gestational hypertension and proteinuria of at least 1 + on the dipstick. The patients who developed preeclampsia were followed until 6 weeks after delivery.

**Statistical analysis:** The data were analyzed and interpreted according to the type of variables. The continuous variables were analyzed in terms of mean and interpreted by student's t-test. The discontinuous variables were described in terms of percentages and interpreted by $\chi^2$ (Chi-square) test.

## Results

**Table - 1** states the similarity of PIH and Normal mothers in respect of their age at the time of booking. The mean age of normal was 26.2 ± 4.5 years and that of PIH mothers was 26.1 ± 2.2 years. The difference in age between them was not statistically significant (P>0.05).

**Table - 1:** Comparison of PIH and normal mothers in respect of their age.

| Age group | Normal | | Pregnancy Induced Hypertension | | Total | |
|---|---|---|---|---|---|---|
| | Frequency | % | Frequency | % | No | % |
| 15-19 | 1 | 1.2 | 0 | 0.0 | 1 | 1.01 |
| 20-24 | 21 | 24.7 | 3 | 21.4 | 24 | 24.24 |
| 25-29 | 51 | 60.0 | 10 | 71.4 | 61 | 61.62 |
| 30-34 | 8 | 9.4 | 1 | 7.2 | 9 | 09.09 |
| 35-39 | 4 | 4.7 | 0 | 0.0 | 4 | 04.04 |
| Total | 85 | 100.0 | 14 | 100.0 | 99 | 100 |
| Mean ± SD | 26.2 ± 4.5 | | 26.1 ± 2.2 | | | |
| Significance | "t" = 0.094, df= 97 and P>0.05. | | | | | |

**Table - 2:** Comparison of systolic and diastolic blood pressure between PIH and normal mothers at the time of booking.

| Blood Pressure | PIH | | Normal | | Differ b/w means | "t" | df | Sig |
|---|---|---|---|---|---|---|---|---|
| | Mean | SD | Mean | SD | | | | |
| SBP | 107.9 | 9.7 | 112.0 | 9.1 | 4.1 | 1.563 | 97 | P>0.05 |
| DBP | 70.7 | 6.2 | 72.0 | 7.4 | 1.3 | 0.618 | 97 | P>0.05 |

**Table - 3:** Comparison of increased SBP and DBP between PIH and normal mothers.

| Blood Pressure | PIH | | Normal | | Differ b/w means | "t" | df | Sig |
|---|---|---|---|---|---|---|---|---|
| | Mean | SD | Mean | SD | | | | |
| SBP | 41.4 | 15.1 | 4.4 | 11.9 | 37.0 | 10.385 | 97 | P<0.001 |
| DBP | 25.0 | 8.5 | 2.6 | 9.7 | 22.4 | 8.167 | 97 | P<0.001 |

**Table - 4:** Comparison of β HCG between the pih and normal mothers.

| Variable | PIH | | Normal | | Differs/w means | "t" | Df | Sig |
|---|---|---|---|---|---|---|---|---|
| | Mean | SD | Mean | SD | | | | |
| β HCG | 54297.8 | 22302.7 | 27018.2 | 11255.7 | 27279.6 | 7.122 | 97 | P<0.001 |

The systolic and diastolic blood pressures of the PIH and normal mothers were compared in the **Table - 2**. The mean SBP of PIH mothers was 107.9 ±9.7 mm/Hg and that of normal mothers

was 112.0 ± 9.12mm/Hg. The difference between them was not statistically significant (P>0.05). The mean DBP of PIH mothers was 70.7±6.2mm/Hg and that of the normal mothers was 72.02± 7.4 mm/Hg. The difference between them was also not statistically significant (P>0.0).

**Table - 5:** Correlation between β HCG with booking SBP and DBP and with at delivery SBP and DBP.

| Time | Variable-1 | Variable-2 | "r" | Sig | $r^2$ | % |
|---|---|---|---|---|---|---|
| At booking | β HCG | SBP | -.067 | P>0.05 | .0045 | 0.45 |
| | β HCG | DBP | -.027 | P>0.05 | .00073 | 0.073 |
| At delivery | β HCG | SBP | +.606 | P<0.001 | .3672 | 36.7 |
| | β HCG | DBP | +.507 | P<0.001 | .257 | 25.7 |

The increase of SBP and DBP between the PIH and normal mothers was compared in the **Table - 3**. The mean increase of SBP of PIH mothers was 41.4±15.1mm/Hg. The mean increase of SBP of Normal mothers was 4.4±11.9mm/Hg. The difference between them was statistically very highly significant (P<0.001). Similarly, the DBP mean increase of PIH mothers was 25.0±8.5mm/Hg. The mean increase of DBP of Normal mothers was 2.6±9.7mm/Hg. The difference between them was statistically very highly significant (P<0.001).

The β HCG levels of PIH and normal mothers were compared in the **Table - 4**. The mean β HCG of PIH group mothers was 54297.8± 22302.7 and that of normal group mothers was 27018.2 ± 11255.7. The difference between the means was statistically very highly significant (P<0.001).

**Table - 5** correlates the blood pressure with the β HCG at booking and delivery. At booking, there was no significantly correlated between the β HCG with either SBP or DBP (P>0.05). But at delivery, the β HCG was very highly correlated with both SBP and DBP (P<0.001). At delivery, the β HCG determined SBP 36.7% and DBP 25.7%.

## Discussion

Hypertension and proteinuria are important complications of pregnancy. Abnormal placentation is one of the important pathologies for the development of GHT. Because of abnormal placentation, there may be an increased synthesis of beta HCG [8]. There may be deregulation of lipoprotein lipase in GHT prone women, that causes elevated plasma lipid and lipoprotein levels, may induce endothelial dysfunction is the prominent pathology, usually occurs in early trimester (8-18 weeks) but signs and symptoms occur in a late trimester [9]. In this study serum beta HCG estimated in the early second trimester, women with elevated levels, categorized under the high-risk group. So it is easy to identify the high-risk women and kept under regular follow up. It helps in preventing the development of complication in GHT. Since the year 1950 HCG is reported to be elevated in toxemic pregnancy [10]. In our study women with higher levels of beta HCG (>2 MOM) during the second trimester of pregnancy, developed PIH later in their pregnancy, with *P* value <0.001 which was statistically significant. 83.33 % of women with elevated levels of beta HCG developed PIH with sensitivity 90.91 %, specificity 97.44 % and the positive predictive value 83.33 % [11]. In a study by Davidge S_et.al 62 cases out of 90 (68.9 %) with values of beta HCG > 2MOM developed PIH against 21 cases out of 130 (16.15 %), having a beta HCG value < 2 MOM. The difference was statistically significant (*P* value <0.001) [12]. Spitz B, et al. showed that with a cut off value of 2 MOM for beta HCG in multipara and primigravida during the second trimester, area below the curve was 0.96 and

0.95, respectively, sensitivity was 88.5 and 100 %, respectively, the positive predictive value was 0.46 and 0.25, respectively, and the negative predictive values were 0.99 and 1.0 [13]. In the present study, the increasing beta HCG levels (in mIU/ml) showed a direct association with the severity of PIH. Similar results were shown in a study by Conrad KP, et al. in which the author concluded that there was a positive correlation between the absolute beta HCG levels and the severity of PIH [14, 15].

## Conclusion

From this study, we found that βHCG levels were elevated in patients having preeclampsia, Compared with patients who remained normotensives throughout pregnancy, but while significant effects reported in this study are too modest compared with natural variability and also sensitivity and positive predictive value of βHCG are too low to be useful as mass screening marker on its own and therefore it 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.

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## References

1. Redman CWG, Sargent IL, Roberts JM. Immunology of abnormal pregnancy and preeclampsia. In Lindheimer MD, Robers JM, Hypertensive disorders of pregnancy, 3rd edition, New York: Elsevier, 2009, p. 129.
2. Borowski K, Kaiser L, Zeng S, et al. Lack of association of FAS gene and preeclampsia. Abstract No 706. Presented at the 29th Annual Meeting of the Society for Maternal-Fetal Medicine, January, 2009, p. 26–31.
3. Buurma AJ, Turner RJ, Driessen JH, et al. Genetic variants in pre-eclampsia: level, urinary excretion, and metabolic production of cGMP during gestation in rats. Am J Physiol., 1989; 257: R847.
4. Staines-Urias E, Paez MC, Doyle P, et al. Genetic association studies in pre-eclampsia: systematic meta-analyses and field synopsis. Int J Epidemiol., 2012; 41(6): 1764.
5. Loisel DA, Billstrand C, Murray K, et al. The maternal HLA-G 1597 DC null mutation is associated with increased risk of pre-eclampsia and reduced HLA-G expression during pregnancy in African-American women. Mol Hum Reprod., 2013; 19(3): 144.
6. Bdolah Y, Palomaki GE, Yaron Y, et al. Circulating angiogenic proteins in trisomy 13. Am J Obstet Gynecol., 2006; 194(1): 239.
7. Redman CW, Tannetta DS, Dragovic RA, et al. Review: does size matter? Placental debris and the pathophysiology of pre-eclampsia. Placenta, 2012; 33(Suppl): S48.
8. Karim R, Assali NS. Pressor response to angiotensin in pregnant and non-pregnant women. Am J Obstet Gynecol., 2001, 82: 246.
9. Raab W, Schroeder G, Wagner R, et al. Vascular reactivity and electrolytes in normal and toxemic pregnancy. J Clin Endocrinol., 1956; 16: 1196.
10. Talledo OE, Chesley LC, Zuspan FP. Renin-angiotensin system in normal and toxemicpregnancies, Differential sensitivity to angiotensin II and norepinephrine toxemia of pregnancy. Am J Obstet Gynecol., 1968; 100: 218.
11. Gant NF, Chand S, Worley RJ, et al. A clinical test useful for predicting the development of acute hypertension in pregnancy. Am J Obstet Gynecology, 1991; 344.

12. Davidge S, de Groot C, Taylor RN. Endothelial cell dysfunction and oxidative stress. In Taylor RN, Roberts JM, Cunningham FG (eds): Chesley's Hypertensive Disorders in Pregnancy, 4th edition, Amsterdam, Academic Press, 2014, p. 89-90.
13. Spitz B, Magness RR, Cox SM. Low-dose aspirin. I. Effect on angiotensin II pressor responses and blood prostaglandin concentrations in pregnant women sensitive to angiotensin II. Am J Obstet Gynecol., 1988; 159(5): 1035.
14. Conrad KP, Vernier KA. Plasma level, urinary excretion and metabolic production of cGMP during gestation in rats. Am J Physiol., 1989; 257: R 847.
15. Ajne G, Wolff K, Fyhrquist F, et al. Endothelin-converting enzyme (ECE) activity in normal pregnancy and preeclampsia. Hypertens Pregnancy, 2003; 22: 215.