



Original Research Article

Evaluation of serum beta HCG levels in pregnant females as a predictor of gestational hypertension

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Keywords:

SBP(Systolic Blood Pressure)

DBP(Diastolic Blood Pressure)

b -HCG (Beta Human Chorionic Gonadotrophin)

GHT(Gestational Hypertension)

IUGR(Intra Uterine Growth Restriction)

LBW (Low Body Weight) ELISA

(Enzyme Linked Immuno Sorbent Assay

ABSTRACT

Background: Human β -HCG is a glycoprotein that is expressed in trophoblastic cells and various malignant tumors. Placenta is the known primary trigger of gestational hypertension. Beta HCG is secreted in abundance from placenta.

Aims and Objectives: The aim of the present study is to estimate the serum Beta HCG levels in study group consisting of 50 patients (Pregnant Females) of gestational hypertension and in control consisting of same age matched pregnant females.

Materials and Methods: The present hospital based observational and analytical study was conducted on 80 patients out of which 50 were diagnosed with gestational hypertension and 30 constituted the control group. The Beta HCG levels were analyzed by Sandwich ELISA Method.

Results: The results of the present study showed that there was increase in Beta HCG levels in the gestational hypertensive patients with a mean value of Beta HCG was 117.79 ± 57.7 mIU/ml, mean value of Systolic blood pressure was 127.3 ± 13.9 mm of Hg and mean value of Diastolic blood pressure was 78.6 ± 16.1 mm of Hg which were statistically significant ($p < 0.001$).

Conclusion: Serum Beta HCG levels were elevated in gestational hypertension, when compared with controls. Due to trophoblast response to hypoxia there exists an abnormal secretory function of the placenta in cases of gestational hypertension which leads to development of a hypersecretory state which is seen as a rise in Beta HCG levels. This study showed that estimating serum Beta HCG levels is a useful indicator to identify women who are likely to develop gestational hypertension in the same pregnancy.

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1. Introduction

Human chorionic gonadotrophin is synthesized by the syncytiotrophoblast cells of the placenta.¹ HCG is a glycoprotein with the highest carbohydrate content of any hormone in the human body. Like all glycoproteins, it consists of two subunits: α (92 amino acids) and β (145 amino acids), of which the α sub unit is structurally and immunologically similar in, LH, FSH and TSH and β subunit is unique to HCG.²

(GHT) is a unique disease seen only in pregnancy affecting 12–15% of all pregnant women in nullipara 6–15% and 2–4% in multipara. In spite of improvement

in maternal and neonatal care, GHT and its sequelae are a dreaded complication of pregnancy. Gestational hypertension is defined as the presence of systolic blood pressure more than 140mm of Hg and diastolic blood pressure more than 90mm of Hg after 20 weeks of gestation without proteinuria.³ Hypertension and proteinuria are the important complications of pregnancy and are associated with high maternal and perinatal mortality and morbidity.⁴

Placenta is known as the primary trigger of gestational hypertension. Beta HCG is secreted in abundance from placenta. In severe gestational hypertension usually the cytotrophoblasts of the developing placenta migrate through the decidua and myometrium and invade the tunica media of the spiral arteries which supply blood to the fetus.⁵ Thus

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the spiral arteries fail to penetrate the myometrial segment and remain narrow. So, there is hypoperfusion of placenta leading on to placental ischemia which results in elevated HCG production.⁶ Hence in gestational hypertension, focal cellular necrosis occurs in the syncytiotrophoblast and there is increased mitotic activity with proliferation of the cytotrophoblast.^{7,8} There is a relationship between gestational hypertension and increased maternal serum Beta-HCG levels, which indicates that there is an abnormal secretory function of the placenta in patients with GHT.

Therefore, this study was planned to assess the relationship between serum Beta HCG levels and gestational hypertension.

1.1. Risk factors

1. Age (young & elderly primi gravida).
2. Interval from last pregnancy > 10 yrs.
3. Obesity BMI > 35kg/ m²
4. Chronic hypertension.
5. Renal disease.
6. Systemic lupus erythematosus.
7. H/O smoking.
8. Abnormal uterine artery Doppler at 18 -24 weeks⁹

2. Materials and Methods

This hospital based observational and analytical study was conducted in the Department of Biochemistry, GMC, Patiala in collaboration with the Department of Obstetrics & Gynaecology, Rajindra Hospital, Patiala on Patiala which comprised of 50 diagnosed cases of GHT (Pregnant Female) & control group comprised of 30 patients (Pregnant Female) of same age matched group. The levels of Beta HCG were estimated in both groups and was subjected to statistically analysed.

2.1. Sample collection

A volume of 5-7 ml of peripheral venous blood was collected by vein puncture using a dry disposable syringe between 8 to 9 am after an overnight fasting from both the groups. Then blood was allowed to clot for 30 min and centrifuged at 2200-2500 rpm for 5-10 min for separation of serum. Serum was stored in aliquots at 2-8 degree Centigrade for 5 days and at -20 degree Centigrade for up to one month under aseptic conditions.

2.2. Equipment

Elisa reader with washer.

3. Method

Beta HCG levels were estimated by Sandwich Elisa Method.

3.1. Inclusion criteria

1. Patients with previous history of GHT.
2. Antenatal mothers in the gestational age of 14-20 wks.

3.2. Exclusion criteria

Patients of

1. Hypertension diagnosed before 20 wks of gestation
2. Diabetes
3. Multiple pregnancy
4. Molar pregnancy
5. Hypothyroidism
6. USG proven fetal congenital malformation

4. Statistical analysis

The data was analysed using Microsoft excel 7 pearsons correlation and Anova tests.

The two continuous variables namely Beta HCG (mIU/ml) and Blood Pressure (mm of Hg) in pregnant females were taken and to measure correlation between these two quantitative variables. Pearsons correlation coefficient (r) was calculated by using Microsoft Excel 7, and Based on the values of pearsons correlation coefficient, here correlation was judged as 0-0.2 (very weak), 0.3-0.5 (moderate), 0.5-0.7 (strong) and 0.7-1 (very strong) p value :- A p value of less than <0.001 was taken as highly significant.

5. Results

Table 1 shows a comparison of Beta HCG levels in the study group and control group. The study group were 50 in number and control group were 30 in number. The mean value of Beta HCG was 111.0 ± 56.0 (mIU/ml) in study group and 2.84 ± 0.95 (mIU/ml) in control group respectively. It was observed that levels of Beta HCG were more in study group as compared to control group which was statistically highly significant ($p < 0.001$).

Table 2 shows a comparison of age with gestational hypertension in study group. The Mean $\pm$ SD of age in the age group ≤ 25 years, 26-30 years and >30 years was 24.00 ± 1.323 , 33.17 ± 1.941 and 28.53 ± 1.356 respectively.

The Mean + SD of (SBP) in the age group ≤ 25 years, 26-30 years and >30 years was 123.08 ± 13.9 , 129.13 ± 13.0 , and 128.46 ± 15.1 respectively.

The Mean + SD of (DBP) in the age group ≤ 25 years, 26-30 years, and >30 years was 73.8 ± 16.1 , 80.4 ± 17.7 and 80.0 ± 15.6 respectively. It was observed that when Mean + SD of age is compared with Mean + SD of GHT there was a positive comparison between the two which was statistically highly significant ($p < 0.001$).

Table 3 shows a comparison of age with Beta HCG levels in study group and control group. The Mean $\pm$ SD of age in study group and control group was 28.30 ± 3.253 and 28.10 .

Table 1: Shows the comparison of beta HCG levels in study group and control group

		Mean $\pm$ SD (mIU/ml)	P value	Significance
BETA HCG (mIU/ml)	Study Group (n=50)	111.0 $\pm$ 56.0	<0.001	HS
N.V- Less than 5mIU/ml	Control Group (n=30)	2.84 $\pm$ 0.95		

Table 2: Shows the comparison of age with ght in study group

Age (in years)	Mean $\pm$ SD (AGE)	Mean $\pm$ SD (SBP) (mm of Hg)	P Value	Mean $\pm$ SD (DBP) (mm of Hg)	P value	Significance
≤ 25	24.00 $\pm$ 1.323	123.08 $\pm$ 13.9	<0.001	73.8 $\pm$ 16.1	<0.001	HS
26-30	33.17 $\pm$ 1.941	129.13 $\pm$ 13.0		80.4 $\pm$ 17.7		
>30	28.53 $\pm$ 1.356	128.46 $\pm$ 15.1		80.0 $\pm$ 15.6		
Total	28.10 $\pm$ 3.556	127.3 $\pm$ 13.9		78.6 $\pm$ 16.1		

Table 3: Shows comparison of age with beta HCG levels in study group and control group

		Mean $\pm$ SD (Age)	Mean $\pm$ SD (Beta HCG (mIU/ml))	P Value	Significance
Age (Years)	Study Group (n=50)	28.30 $\pm$ 3.253	111.0 $\pm$ 56.0	<0.001	S
	Control group (n=30)	28.10 $\pm$ 3.556	2.84 $\pm$ 0.95		

± 3.556 and the Mean $\pm$ SD (Beta HCG in study group and Control group was 111.0 $\pm$ 56.0 and 2.84 $\pm$ 0.95 respectively. It was observed that when Mean $\pm$ SD of age is compared with Mean $\pm$ SD of Beta HCG there was a positive comparison between the two which was statistically significant ($p < 0.001$).

Table 4 shows a correlation of beta HCG levels with gestational hypertension (SBP) in study group. The Mean $\pm$ SD of SBP was 128.46 $\pm$ 15.1, 129.13 $\pm$ 13.0, and 123.08 $\pm$ 14.3 in the age group of ≤ 25 , 26-30, and >30 years respectively. The Mean $\pm$ SD of Beta HCG was 114.23 $\pm$ 59.6, 117.79 $\pm$ 57.7 and 95.3 $\pm$ 49.8 in the age group of ≤ 25 , 26-30, and >30 years respectively. It was observed that with increase in the gestational hypertension (SBP) the levels of Beta HCG were also increased with the mean value of 117.79 $\pm$ 57.7 (mIU/ml). So, there was a positive correlation between the Beta HCG and SBP ($r = +0.84$) and was statistically highly significant ($p < 0.001$).

Table 5 shows a correlation of Beta HCG levels with gestational hypertension (DBP) in patients. The Mean $\pm$ SD of DBP was 73.8 $\pm$ 16.1, 80.4 $\pm$ 17.7, and 80.0 $\pm$ 15.6 in the age group of ≤ 25 , 26-30, and >30 years respectively. The Mean $\pm$ SD of Beta HCG was 114.23 $\pm$ 59.6, 117.79 $\pm$ 57.7 and 95.3 $\pm$ 49.8 in the age group of ≤ 25 , 26-30, and >30 years respectively. It was observed that with increase in the gestational hypertension (DBP) the levels of Beta HCG were also increased with the mean value of 117.79 $\pm$ 57.7 (mIU/ml). So, there was a positive correlation between the two ($r = +0.92$) and was statistically highly significant ($p < 0.001$).

6. Discussion

It was found that serum Beta HCG levels were elevated in gestational hypertension, more significantly elevated in severe gestational hypertension when compared with the controls. Due to trophoblast response to hypoxia there exists an abnormal secretory function of the placenta in cases of gestational hypertension which leads to development of a hypersecretory state which is seen as a rise in Beta HCG levels.

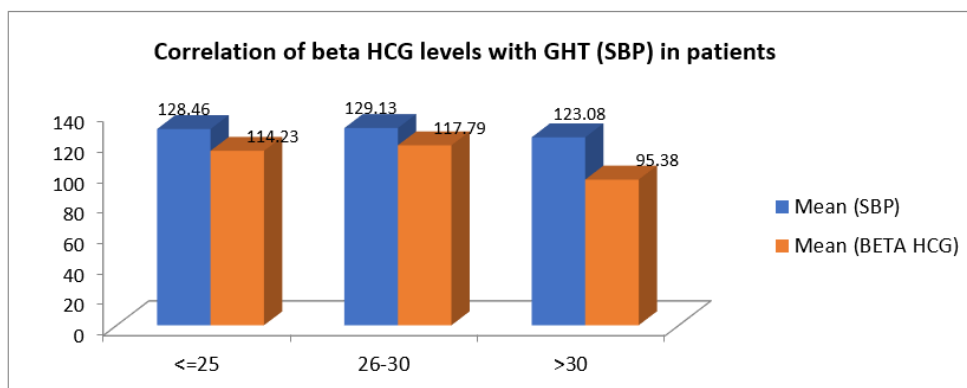
Table 1 of present study showed that the levels of Beta HCG are more in study group as compared to control group which was statistically highly significant ($p < 0.001$). Similar results were shown by Basirat Z et al. (2006)¹⁰ in which the author reported that the maternal serum Beta HCG levels in patients with gestational hypertension was higher in study group than in the control group ($p < 0.001$). Our findings were also in conformity with the findings of Gurbuz et al. (2004)¹¹ and Choudhury KM et al. (2012).¹²

Table 2 of the present study showed the comparison of age with gestational hypertension, in which the mean value of AGE was 28.10 $\pm$ 3.55, SBP was 127.3 $\pm$ 13.9 and DBP was 78.6 $\pm$ 16.1 respectively which was statistically highly significant ($p < 0.001$). The present study was correlated with the other studies conducted by Yadav et al. (1997)¹³ and Bangal VB et al. (2011)¹⁴ which were also statistically significant ($p < 0.001$).

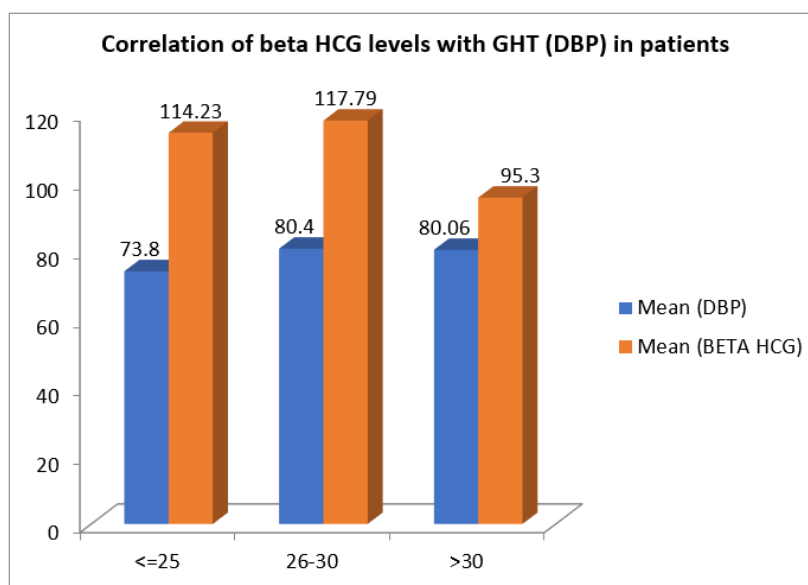
The increase in blood pressure due to fact that the maternal cardiovascular system undergoes progressive adaptations throughout pregnancy, including increased vascular resistance, increased blood volume, and other metabolic changes.¹⁵ These leads to changes in the systemic

Table 4: shows the correlation of beta HCG levels with GHT (SBP) in study group

Age (years)	No. of Patients	Mean+SD (SBP) (mm of Hg)	Mean+SD(BETA HCG) (mIU/ml)	r value	P value	Significance
≤25	13	128.46 ± 15.1	114.23 ± 59.6	+0.84	<0.001	HS
26-30	24	129.13 ± 13.0	117.79 ± 57.7			
>30	13	123.08 ± 14.3	95.3 ± 49.8			
Total	50	127.3 ± 13.9	111.0 ± 56.0			

**Fig. 1:** Correlation of Beta HCG levels with GHT (SBP) in Study Group**Table 5:** Shows the correlation of beta hcg levels with GHT (DBP) in study group

Age (years)	No. of Patients	Mean + SD (DBP) (mm of Hg)	Mean +SD(BETAHCG) (mIU/ml)	r value	P value	Significance
≤25	13	73.8 ± 16.1	114.23 ± 59.6	+0.92	<0.001	HS
26-30	24	80.4 ± 17.7	117.79 ± 57.7			
>30	13	80.0 ± 15.6	95.3 ± 49.8			
Total	50	78.6 ± 16.1	111.0 ± 56.0			

**Fig. 2:** Correlation of Beta HCG levels with GHT (DBP) in study group

blood pressure.

Table 3 of our study showed the comparison of age with Beta HCG levels in the study group as compared to control group was statistically highly significant ($p < 0.001$).

Our findings were also in conformity with the findings of Rajesh et al. (2018).¹⁶

Table 4 and Table 5 of our study shows the positive correlation of Beta HCG with gestational hypertension. The study is consistent with the other studies conducted by Vidyabati R K, et al. (2007)¹⁷ in which the authors concluded that there was a positive correlation between the absolute Beta HCG levels and the severity of gestational hypertension. The study is inconsistent with the studies conducted by Satyanarayn et al (2001)¹⁸ who found no correlation between elevated serum Beta HCG levels and GHT.

In gestational hypertension the rise of blood pressure is due to constriction of blood vessels and angiogenesis was impaired which leads to hypoxia and hyperplasia of trophoblastic cells which causes increased production of placental hormone ultimately leading to more level of circulating β -HCG. As GHT is a disorder of trophoblastic cells, elevated β -HCG levels is thought to cause early placental damage or dysfunction.^{19,20}

GHT probably reduces uteroplacental perfusion as a result of abnormal cytotrophoblast invasion of spiral arterioles. Placental ischemia is thought to lead to wide spread activation/dysfunction of the maternal vascular endothelium that results in enhanced formation of endothelin and thromboxane, increased vascular sensitivity to angiotensin II, and decreased formation of vasodilators such as nitric oxide and prostacyclin ultimately there occurs placental hypoxia which results in increased levels of Beta HCG.

7. Conclusion

This study showed that estimation of serum Beta HCG levels in early second trimester of pregnancy is a useful indicator to identify women who are likely to develop gestational hypertension in the same pregnancy. The level of beta HCG is strongly associated with development of GHT. This can be used as “POWERFUL PREDICTIVE TOOL” by the obstetricians for early identification and expert management of gestational hypertension. β HCG are low to be useful as a mass screening marker as a single tool 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.

8. Limitations

There are some limitations in this study. First our study group consists of less number of patients, so it is difficult

to analyze the association between the serum Beta HCG level and gestational hypertension. Second our study was conducted cross-sectionally, so it was also insufficient to clarify the causative relationship between serum Beta HCG levels and gestational hypertension. Further it needs a study on large no. of population.

9. Source of Funding

None.

10. Conflict of Interest

None.

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