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Original Research Article

Study of significance of elevated maternal serum β -human chorionic gonadotropin (β -hCG) level in 16 to 20 weeks pregnant women as predictor of hypertensive disorder of pregnancy

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ABSTRACT

Background: Hypertensive disorder of pregnancy affects both mother and fetus, leading their high morbidity and mortality and a major killer of women in developing country. The etiologic of preeclampsia is still not clear. It seems that placenta plays main role in path-physiology of preeclampsia, but there is strict relationship between hypertensive disorder of pregnancy and elevated β -hCG level, indicating there should be an abnormal placental secretary function in patients with severe preeclampsia.

Methods: 245 patients were recruited from our institute (OPD) and Prospective analytical study was started with 16-20 weeks pregnant women. Cases were subjected to detailed history and thorough physical examination including baseline blood pressure. β -hCG measurement was done between 16-20 weeks and cases were followed at regular interval for the development of hypertensive disorder of pregnancy. Statistical testing was conducted with appropriate tests.

Results: Total 245 women were enrolled in the study, only 208 were followed till delivery, 24 were developed hypertension. On analysis of data, maximum cases were younger, primigravida and of lower class. β -hCG levels (Mean \pm SD) were also significantly higher (30100 \pm 16250 V/S 74700 \pm 23790; $p < 0.001$) in subjects who later developed hypertension. Cut off value of β -hCG was 45755 mIU/ml, and analysis establishes validity of β -hCG as predictor of hypertensive disorder of pregnancy with sensitivity, specificity, positive and negative predictive value for β hCG were 87.5, 83.2, 70.4 and 83.7% respectively.

Conclusions: Present study shows that elevated serum β -hCG in early second trimester can be considered as predictor of subsequent hypertensive disorder of pregnancy.

Keywords: β -hCG, Early second trimester, Hypertensive disorder of pregnancy

INTRODUCTION

Hypertension in pregnancy is one of the leading etiologies of maternal mortality and can complicate 5-10% of pregnancy.¹

Maternal mortality due to Hypertensive disorder of pregnancy is reported to be around 10%.² Moreover half of diseases are preventable.³ It is responsible for about

25% of all fetal growth retardations and about 15% preterm birth. It is more common below 20yr of age.⁴ The etiologic of preeclampsia is still not clear. Considering the high importance of complication during pregnancy, a quite a large number of studies have been performed to evaluate risk factors of elderly gravida, young primigravida, older multigravida, race, genetic factors, environmental factors, obesity, poverty and chronic hypertension all to be considered as contributory.⁵⁻⁷

Although pathogenesis of preeclampsia is not clearly determined, it seems that placenta plays main role in path-physiology of preeclampsia. Several evidences such as definite treatment of preeclampsia by delivery of placenta and occurrence of preeclampsia in the presence of viable fetus (placenta) confirm this hypothesis. Maternal serum hCG level peaks at 8-10 weeks of gestation and then declines to reach a plateau at 16-20 week of gestation. The free β subunit can derive from these sources namely, direct trophoblast cell production, dissociation of hCG into free alpha and beta subunit, and by macrophages and neutrophil enzymes nicking the hCG molecule. The free β -hCG circulating in maternal circulation corresponds to only about 0.3-4% of total hCG.

There is strict relationship between hypertensive disorder of pregnancy and elevated β -hCG level, indicating there should be an abnormal placental secretory function in patients with severe preeclampsia.⁸

At present there is no reliable screening test for hypertensive disorder of pregnancy during second trimester. In our Indian setup where the follow up is poor, an initial screening test like serum β -hCG level may help in categorizing patients that require more attention. Pregnant women with high β -hCG levels in early pregnancy have significantly higher risk for development of gestational hypertension. The serum β -hCG, lipid profile and uric acid levels were also found on higher side in the hypertensive group as compared to the normotensive pregnant females. Thus, this study will be designed to find out the β -hCG test in early pregnancy as a screening test for preeclampsia.

Since preeclampsia is characterized by a complex pathophysiology with heterogeneous clinical and laboratory finding there have been many markers to predict the disorder to prevent. For the most, these have resulted in testing strategies with poor sensitivity and with poor positive- predictive value for preeclampsia.⁹⁻¹¹ First trimester biochemical markers and ultrasound Doppler findings are important markers. A combination of two or more marker improves the possibility of prediction.¹²

The objectives of the present study were to measure the β -hCG level in 16-20 weeks pregnant women, to follow these pregnant women for development of hypertensive disorder of pregnancy, and to determine the correlation of serum β -hCG level and hypertensive disorder of pregnancy.

METHODS

Patients were recruited from outpatient department (OPD) from our institute. Target population to be enrolled in this study was 245 pregnant women of 16 to 20 week gestation who were attending out-patient department of obstetrics and gynecology, Deen Dayal

Upadhyay hospital New Delhi in the period of one year (assuming 80% as the sensitivity of serum β -hCG as predictor of hypertensive disorder of pregnancy with 5% margin of error, the minimum required sample size at 5% level of significance is 245 patients). A Prospective analytical study was started with 16 to 20 weeks of gestation pregnant women.

Inclusion criteria

- Pregnant women of 16-20 weeks gestation, who were normotensive and non-proteinuria were included.

Exclusion criteria

- Registered after 20 weeks of gestation.
- Pregnant women with Essential hypertension.
- Multiple pregnancies.
- Gestational trophoblastic diseases.
- Previous history of gestational trophoblastic diseases.
- Congenital malformation of fetus.

Cases were recruited after satisfying inclusion criteria. Patients were informed about the study and informed consent was taken. Cases were subjected to detailed history (at time of registration or at least before 16-20 weeks of gestation) and through physical examination including baseline blood pressure. Baseline blood pressure using a sphygmomanometer was recorded by auscultatory method. Baseline investigation with β -hCG measurement was done at the time of recruitment.

β -hCG measurement

2 milliliter venous blood sample was obtained from cases. After coagulation of blood, each sample was centrifuged for 10 min at 3000 rpm to get a clear cell free serum and the sample was isolated. Then Serum β -hCG was analyzed by using analyzer machine with the help of Immulite1000 hCG. Method used was CLIA method (Chemiluminescence immune-metric assay).

Cases were followed at regular interval for the development of hypertensive disorder of pregnancy-

- For 20-28 week: at every 30 days interval.
- For 28-36 week: at every 15 days interval.
- For 36-40week: at every 7 days interval.

Statistical analysis

Statistical testing was conducted with the statistical package for the social science system version SPSS 17.0. Data were analysed by using Student's t test, Chi-squared test, Fisher's exact test and Mann Whitney U test according to types of data.

A receiver operating characteristics (ROC) analysis was done to determine optimal cut-off value for serum β -hCG. The area under the curve, the sensitivity, and the

specificity was also calculated to analyse the screening accuracy of serum β -hCG.

For all statistical tests, P-Value less than 0.05 were taken, to indicate a significant difference.

RESULTS

Total 245 women were enrolled in the study but, only 208 women were completely followed till delivery. 16 pregnancies were spontaneously aborted and 4 pregnancies were having congenital anomalies, whereas 17 patients were lost to follow up.

Prevalence

Table 1: Distribution of cases according to development of hypertensive disorder of pregnancy.

HDP Developed	Frequency	%
N	184	88.5
Y	24	11.5
Total	208	100

Out of total 208 cases finally evaluated, 24 (11.5%) cases were developed hypertension, and remaining 184 (88.5%) cases were normotensive.

Table 2: Distribution of cases according to socio-economic status and development of hypertensive disorder of pregnancy.

SES*	Total cases	HDP Developed				P value
		N		Y		
		Frequency	%	Frequency	%	
L	134	116	63.0%	18	75.0%	0.250
M	74	68	37.0%	6	25.0%	
Total	208	184	100%	24	100%	

*Socioeconomic status

Table 3: Distribution of cases according to age groups and development of hypertensive disorder of pregnancy.

Age (years)	Cases	HDP Developed				P- value
		N		Y		
		Frequency	%	Frequency	%	
18 – 20	34	32	17.4	2	8.3	0.449
21 - 25	125	108	58.7	17	70.8	
26 - 30	41	36	19.6	5	20.8	
>35	8	8	4.3	0	0.0	
Total	208	184	100	24	100	

Table 4: Distribution of cases according to gravidity and development of hypertensive disorder of pregnancy.

Gravida	Cases	HDP Developed				P-Value
		N		Y		
		Frequency	%	Frequency	%	
1	119	102	55.4	17	70.8	0.588
2	55	50	27.2	5	20.8	
3	23	21	11.4	2	8.3	
4	8	8	4.3	0	0.0	
5	3	3	1.6	0	0.0	
Total	208	184	100	24	100	

Socioeconomic status

Out of 24 cases those developed hypertension, maximum no. of cases i.e. 75% (18 cases) were of lower-class family. p-value was 0.250 which is statistically not significant; indicate that there was no statistically significant association between socioeconomic status and

HDP. But occurrence of HDP was more among lower class family.

Age

Maximum numbers of cases i.e. 125 were in 21-25 years age group.

p-value was 0.449, which is statistically not significant, indicated that there was no statistically significant association between age and HDP.

But occurrence of HDP was more among 21 to 25 year of age.

Gravidity

Among gravidity, maximum numbers of cases i.e. 119 were primigravida. p-value was 0.588 which was statistically not significant, indicated that there was no statistically significant association between gravidity and HDP.

Basal metabolic index

Table 5: Comparison of mean BMI with development of hypertensive disorder of pregnancy.

	HDP Developed		P value
	Y	N	
	Mean±SD	Mean±SD	
BMI	21.83±2.01	21.59±1.57	0.506

Mean BMI of normotensive cases was found to be 21.83±2.0, and of hypertensive cases was found to be 21.59±1.57. Statistical analysis was not significant (p-value-0.506), thus both the groups were comparable for BMI.

Table 6: Comparison of mean β-hcg value with development of hypertensive disorder of pregnancy.

	No HDP Developed (n=184)		HDP Developed (n=24)		P value
	Mean±SD	Median (IQR)	Mean±SD	Median (IQR)	
β-hCG value	30100±16250	28200 (16900-40700)	74700±23790	72200 (58900 - 91500)	<0.001

Table 7: Distribution of cases according to β-hcg value and development of hypertensive disorder of pregnancy.

β-hCG	Cases	HDP Developed				P value
		N		Y		
		Frequency	%	Frequency	%	
<10000	20	20	10.9	0	0.0	<0.001
10000-20000	38	38	20.7	0	0.0	
20000-30000	47	46	25.0	1	4.2	
30000-40000	33	32	17.4	1	4.2	
40000-50000	31	28	15.2	3	12.5	
50000-60000	15	14	7.6	1	4.2	
60000-70000	8	4	2.2	4	16.7	
70000-80000	6	1	0.5	5	20.8	
80000-90000	3	0	0.0	3	12.5	
90000-100000	5	1	0.5	4	16.7	
>100000	2	0	0.0	2	8.3	
Total	208	184	100	24	100	

β-hCG

The mean β-hCG values for hypertensive and normotensive cases were 74700 ± 23790 and 30100 ± 16250 respectively. So, Hypertensive cases had higher value of mean β-hCG as compare to normotensive cases. p-value - <0.001, showed that hypertensive cases had statistically significant higher mean β-hCG value as compare to normotensive cases.

It showed increasing β-hCG value had a direct association with development of hypertensive disorder of pregnancy. Those developed hypertension, maximum cases i.e. 20.8% (5 cases) had β-hCG value between

70,000- 80,000, but among normotensive cases, maximum cases i.e. 25.0% (46 cases) had β-hCG value between 20,000- 30,000. p-value was <0.001 which is statistically significant; indicate that there was statistically significant association between β-hCG value and HDP.

It showed that, 2 cases (8.3%), which developed hypertension, were having β-hCG < 40000 m IU/ml, whereas 22 cases (91.7%), which developed hypertension, were having β-hCG > 40000 m IU/ml. p-value was <0.001 which is statistically significant; indicated that statistically significant association found between β-hCG value and HDP.

Table 8: Correlation between β -hcg value and development of hypertensive disorder of pregnancy.

β -hCG value	Total cases	HDP Developed				P value
		N		Y		
		Frequency	%	Frequency	%	
<40000	138	136	73.9%	2	8.3%	<0.001
\geq 40000	70	48	26.1%	22	91.7%	
Total	208	184	100%	24	100%	

Table 9: Correlation between β -hcg value and systolic blood pressure.

SBP	Cases	β -hCG value				P value
		<40000		\geq 40000		
		Frequency	%	Frequency	%	
<140	184	136	98.6	48	68.6	<0.001
140 – 160	9	2	1.4	7	10.0	
>160	15	0	0.0	15	21.4	
Total	208	138	100	70	100	

Systolic and diastolic blood pressure

Cases which were having β -hCG <40000, maximum no. of cases 136 (98.6%) had systolic blood pressure within normal range.

Whereas cases which were having β -hCG >40000, 7 cases (10%) had mild preeclampsia, while 15 cases (21.4%) had severe preeclampsia.

p-value was <0.001, which is statistically significant; indicate that as β -hCG value increases, severity of hypertensive disorder of pregnancy increases significantly.

Cases which were having β -hCG <40000, maximum no. of cases 136 (98.6%) had diastolic blood pressure within normal range. Whereas cases which were having β -hCG >40000, 17 cases (24.2%) had mild preeclampsia, while 5 cases (7.1%) had severe preeclampsia.

Table 10: Correlation between β -hcg value and diastolic blood pressure.

DBP	Cases	β -hCG value				P value
		<40000		\geq 40000		
		Frequency	%	Frequency	%	
<90	184	136	98.6	48	68.6	<0.001
90 – 110	19	2	1.4	17	24.2	
>110	5	0	0.0	5	7.1	
Total	208	138	100	70	100	

Table 11: Comparison of mean systolic blood pressure with development of hypertensive disorder of pregnancy at different weeks of gestation.

SBP	HDP Developed		P value
	No	Yes	
	Mean \pm SD	Mean \pm SD	
16-20 weeks	115.18 \pm 7.41	119.58 \pm 9.19	0.009
28+weeks	116.75 \pm 7.15	141.67 \pm 14.43	<0.001
34 +weeks	117.99 \pm 6.24	151.09 \pm 16.22	<0.001
37+weeks	118.81 \pm 7.90	158.00 \pm 14.78	<0.001
40+weeks	121.52 \pm 6.98	146.50 \pm 6.81	<0.001

p-value was <0.001, which is statistically significant; indicate that as β -hCG value increases, severity of hypertensive disorder of pregnancy increases significantly. Difference between mean SBP of

hypertensive and normotensive cases at both 16 to 20 week of pregnancy and 37+ weeks of pregnancy was found to be statistically significant (p-value 0.009 and <0.001 respectively).

Table 12: Comparison of mean diastolic blood pressure with development of hypertensive disorder of pregnancy at different weeks of gestation.

DBP	HDP Developed		P value
	No	Yes	
	Mean \pm SD	Mean \pm SD	
16-20 weeks	76.07 \pm 5.34	77.33 \pm 6.92	0.395
28+weeks	77.02 \pm 5.52	91.33 \pm 9.32	<0.001
34 +weeks	77.50 \pm 5.70	96.00 \pm 8.33	<0.001
37+weeks	77.88 \pm 5.66	99.65 \pm 8.58	<0.001
40+weeks	80.69 \pm 5.27	96.00 \pm 1.63	<0.001

Table 13: Distribution of cases according to hypertensive status and time of delivery.

Delivered	Total cases	HDP Developed			P value
		N	Y		
		Frequency	%	Frequency	
PT	23	16	8.7%	7	0.008
T	185	168	91.3%	17	
Total	208	184	100%	24	

Table 14: Distribution of cases according to hypertensive status and perinatal outcome.

Perinatal Outcome	Total cases	HDP Developed				P value
		N	Y			
		Frequency	%	Frequency	%	
IUD	10	7	3.8%	3	12.5%	0.001
Live	166	154	83.7%	12	50.0%	
NICU	32	23	12.5%	9	37.5%	
Total	208	184	100%	24	100%	

Difference between mean DBP of hypertensive and normotensive cases at 16 to 20 weeks of pregnancy was not found to be statistically significant (p value 0.395), but at 37+ weeks of pregnancy was found to be statistically significant (p-value <0.001).

Time of delivery

Percentage of preterm i.e. 29.2% in hypertensive cases was more as compare to percentage of preterm i.e. 8.7% in normotensive cases. p-value was 0.008 which was statistically significant; indicated that there was statistically significant association between time of delivery and hypertensive disorder of pregnancy.

Perinatal outcome

Percentage of IUD baby i.e. 12.5% and NICU admission i.e.37.5% in hypertensive cases were more as compare to

percentage of IUD baby i.e.3.8% and NICU-admission 12.5% in normotensive cases. p-value was 0.001 which was statistically significant; indicated that there was statistically significant association between poor perinatal outcome and HDP.

β -hCG cut off value

Area under the curve was 0.941. Cut off value of β -hCG was 45755 m IU/ ml. And the analysis establishes the validity of β -hCG as predictor of hypertensive disorder of pregnancy with sensitivity of 87.5%, specificity of 83.2%, positive predictive value of 70.4%, negative predictive value of 98.1%, and accuracy of 83.7%.

DISCUSSION

Prevalence of hypertensive disorder of pregnancy

In present study, 245 cases were recruited, but only 208 cases were completely followed till delivery. In which 24 pregnant women, developed hypertensive disorder of pregnancy, reflecting the prevalence rate of hypertensive disorder of pregnancy (11.5%). So, present study is closely representing prevalence rate of hypertensive disorder of pregnancy in India (5-10%). Present study is comparable with various other authors as Chowdhary H et-al, Mallick MP et al, N. Kurinji Priya et al and Yadav K et al (prevalence rate 13.20%, 18.00%, 17.64% and 11.50% respectively).¹³⁻¹⁶

Socioeconomic status

In present study, maximum numbers of cases belong to the lower socioeconomic status (i.e. 63% in normotensive and 75% in hypertensive group). But there was no statistically significant association found between socioeconomic status and hypertensive disorder of pregnancy.

Uddin AW et al was observed in their study that hypertensive disorders were significantly high (54%) in women with lower socio-economic status.¹⁷ Kour G et al¹⁸, Moslemizadeh N et al and Lindsa M Silva et al studies were comparable to present study.¹⁸⁻²⁰

Maternal age

In present study, the mean maternal age of hypertensive cases was found to be 23.47 ± 3.39 years while of normotensive cases was 23.75 ± 2.45 year with p-value 0.693 (not significant).

Study done by Basirat Z et al showed that mean maternal age of hypertensive and normotensive cases were 24.88 ± 0.6 years and 25.2 ± 5.0 years respectively.²¹ Similarly, Moslemizadeh N et al¹⁹ (27.26 ± 5.86 years), Tabeu PM et al (23.5 ± 7.1 years) and Sivakumar S et al (24.3 years) studies were in consonance with present study.^{22,23} Several other studies worldwide have reported that there was no statistically significant association found between maternal age and hypertensive disorder of pregnancy. But occurrence of HDP was found more among the younger age group.

Gravidity

In present study, maximum number of cases was primigravida (57.21%). Similar to present study Chowdhary H et al and Yadav K et al in their study showed that maximum number of cases was primigravida.^{13,16}

BMI

Mean BMI of normotensive cases was found to be 21.59, as compare to mean BMI of hypertensive cases which was 21.83 with p-value 0.718, thus both the groups were comparable for BMI. Due to less number of cases with

elevated BMI, it is difficult to comment on the relation of HDP and BMI.

Begum Z et al and Mamatha S, Singh S et al studies were comparable with present study.^{24,25}

Maternal serum β -hCG

Present study showed that hypertensive cases had high mean β -hCG value as compare to normotensive cases. The mean β -hCG value of normotensive cases was found to be 30100 ± 16250 , while that of hypertensive cases was 74700 ± 23790 with p-value <0.001 which was significant.

Similar to present study Basirat Z et al found that the mean serum β -hCG levels in the hypertensive group was 39854 ± 24630 IU/L, and in the normotensive group 27460 ± 25862 IU/L with p-value 0.031 which was significant.²¹ A study by Dayal M et al also observed a significant rise of mean serum β -hCG level (16130.2 mIU/ml, >2.5 MOM, p-value <0.001) in those who developed preeclampsia.²⁶ Studies done by Choudhary KM et al and Mallick MP et al were comparable to present study.^{14,27}

Distribution of cases according to β -hCG value

Increasing β -hCG value had a direct association with development of hypertensive disorder of pregnancy. p-value was found (<0.001) statistically significant; indicate that there was statistically significant association between β -hCG value and HDP.

In comparison to present study Dr. N. Kurinji Priya in their study found that the levels of serum hCG was higher in patients with the tendency to develop PIH in the course of pregnancy and this increased level were statistically significant (p-value <0.05).¹⁵

Similar findings were observed in Chowdhary H et al and Kaur G et al studies.^{13,18}

Correlation of β -hCG with HDP

As compare to present study, Similar results were found in the study done by Mallick MP et al, where the prevalence rate of PIH/preeclampsia increases as the level of maternal serum β -hCG increases and found that 95% prevalence rate in those women having serum β -hCG level 40,000 m IU/L and above.¹⁴

Kour G et al in their study observed that one case (7.69%) out of 8 in $< 80,000$ m IU/L group had severe PIH, while for $>80,000$ m IU/L group 12 cases (98.5%) out of 14, had severe PIH, giving p-value of <0.01 , which is statistically significant.¹⁸ Similar to present study Basirat Z et al found that in both mild and severe form of preeclampsia, β -hCG was higher than the normal cases (p-value <0.0001).²¹

Mean SBPs

In present study at 16-20 weeks of pregnancy mean SBP of normotensive cases was found to be 115.18 ± 7.41 , and of hypertensive cases was found to be 119.58 ± 9.19 , with p value 0.009, which showed difference was statistically significant. And at 37+ weeks of pregnancy mean SBP of normotensive cases was found to be 118.81 ± 7.90 , and of hypertensive cases was found to be 158.00 ± 14.78 , with p value 0.001, that was also statistically significant. It indicates that, significant difference in blood pressure between hypertensive pregnant women and normotensive pregnant women can be observed since the first trimester, much before the actual clinical diagnosis of hypertensive disorder of pregnancy. Similar results were found in the studies done by Kumari P et al and Mallick MP et al, systolic blood pressure of hypertensive cases was significantly higher than normotensive cases in second trimester and also at term.^{14,28}

Mean DBPs

Diastolic blood pressure in early second trimester weren't varying significantly, but diastolic blood pressures of hypertensive cases at term were significantly higher as compare to normotensive cases.

Similar results were found in the studies done by Vidyabati RK et al, Yadav K et-al and Mallick MP et al, DBP of hypertensive cases in the second trimester was not significantly higher than the normotensive cases, but at the time of delivery it was found that DBP of hypertensive cases was significantly higher than the normotensive group.^{14,16,29}

Delivery outcome

In present study percent of preterm delivery in hypertensive cases i.e. 29.2% was more as compare to preterm delivery in normotensive cases i.e. 8.7% with p-value 0.008 which was statistically significant, indicated that chances of preterm delivery were increase with the development of hypertensive disorder of pregnancy.

Similar to present study Pairu J, Bharathi KN, et al found that number of preterm delivery was increases with increased severity of hypertension. Uddin AW, Nessa S, et-al observed that 25.4% of hypertensive cases were delivered before 37 completed weeks of pregnancy (i.e. preterm).^{17,30}

In present study we found that percentage of IUD baby (12.5%) and NICU admission (37.5%) in hypertensive cases were more as compare to percentage of IUD baby (3.8%) and NICU-admission 12.5% in normotensive cases, with p value 0.001 which was statistically significant indicated that there was statistically significant association between poor perinatal outcome and HDP. Uddin AW, Nessa S, et al in their study found that there was a significant association between hypertensive

disorders and poor perinatal outcome ($p=0.015$).¹⁷ Fatemeh T, Marziyeh G found that the percentage of NICU admission and need for resuscitation in hypertensive group was 3% and 6.1% respectively.³¹

Diagnostic accuracy of β -hCG

In present study cut off value of β -hCG was 45755 m IU/ml with P-Value- <0.001 , which was statistically significant and Area under ROC curve was found to be 0.941 (95%CL=0.894-0987). And the analysis establishes the validity of β -hCG as predictor of hypertensive disorder of pregnancy with sensitivity of 87.5%, specificity of 83.2%, positive predictive value of 70.4%, negative predictive value of 98.1%, and accuracy of 83.7%. Other studies were comparable with present study.

Table 15: Comparison of diagnostic accuracy of β -hcg with other studies.

Authors	Sensitivity	Specificity	PPV	NPV
Chowdhary H et al ¹³	83.3%	96.9%	80.0%	97.5%
Revankar VM ³²	92.6%	94.9%	78.1%	98.5%
Soundararajan P et al ³³	65%	80%	86%	74%
Present study	87.5%	83.2%	40.4%	98.1%

CONCLUSION

Present study shows that pregnant women with high β -hCG levels have significant higher risk for hypertensive disorder of pregnancy. So, Elevated level of serum β -hCG in early second trimester can be considered as predictor of subsequent hypertensive disorder of pregnancy.

Recommendations

There is a need of large community based prospective studies to evaluate multiple markers for screening of HDP and if it predicts those mothers who subsequently develop HDP, in early part of pregnancy; they may be benefited by close monitoring, timely referrals and interventions.

In this study single β -hCG is used as independent marker to predict the disease and its severity. Since preeclampsia is characterized by a complex pathophysiology with heterogeneous clinical and laboratory finding there have been many markers to predict the disorder to prevent. For the most, these have resulted in testing strategies with poor sensitivity and with poor positive- predictive value for preeclampsia. A combination of two or more marker improves the possibility of prediction. A reliable predictive test would help us to individualize the level of surveillance during pregnancy. And easy and sensitive predictive test would help to save lives.

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REFERENCES

1. Wolde Z, Segni H, Woldie M. Hypertensive disorders of pregnancy in Jimma university specialized hospital. *Ethiop J Health Sci.* 2011; 21(3):147-54.
2. Bardale RV, Dixit PG. Pregnancy-related death: A three-year retrospective study. *J Indian Acad Forensic Med.* 2010;32(1):15-18.
3. Maria B Maternal mortality. Avoidable obstetrical complication. *J Gynaecol Obstet Biol Reprod. (Paris)* 2001;30(6):23-32.
4. Kang A, Struben H. Pre-eclampsia screening in first trimester. *J Gynaecol Obstet.* 2008;65(11):663-6.
5. Duckitt K, Harrington D. Risk factor for preeclampsia at antenatal booking: systemic review of controlled studies. *BMJ* 2005;330(7491):565-6.
6. González AL1, Ulloa Galván G, Alpuche G, Romero Arauz JF. Risk factor for pre-eclampsia ; multivariate analysis .*J Gynaecol Obstet Mex.* 2000;68:357-62.
7. Kashanian M, Baradaran HR, Bahasadri S, Alimohammadi R. Risk Factors for Pre-Eclampsia: A Study in Tehran, Iran. *Arch Iran Med.* 2011;14 (6):412-5.
8. Lambert-Messerlian GM, Silver HM, Petraglia F, Luisi S, Pezzani I, Maybruck WM, et al. Second trimester level of maternal human chorionic gonadotropin and inhibin-a as a predictor preeclampsia in the third trimester of pregnancy. *J soc. Gynaecol Invest.* 2000;7(3):170-4.
9. Lindheimer MD, Conrad K, Karumanchi SA. Renal physiology and disease in pregnancy. In Alpern RJ, Hebert SC (eds): *Seldin and Giebisch's The Kidney: Physiology and Pathophysiology*, 4th ed. New York, Elsevier, 2008a, p 2339.
10. Conde-Agudelo A, Romero R, Roberts JM. Tests to predict preeclampsia. In Taylor RN, Roberts JM, Cunningham FG (eds): *Chesley's Hypertensive Disorders in Pregnancy*, 4th ed. Amsterdam, Academic Press, 2014.
11. Odibo AO, Rada CC, Cahill AG, Goetzinger KR, Tuuli MG, Odibo L. First-trimester serum soluble fms- like tyrosine kinase-1, free vascular endothelial growth factor, placental growth factor and uterine artery Doppler in preeclampsia. *J Perinatal.*2013; 2013;33(9):670.
12. International journal of Medicine and Applied sciences, ISSN 2320-3137. Department of Biochemistry, Amla institute of Medical Science, Thrissur Kerala.
13. Chowdhary H, Khurshid R, Praveen S, Yousuf S, Tali SH, Shah ZA. Utility of second trimester β -hCG levels in prediction of gestational hypertension: a prospective cohort study. *Int J Reprod Contracept Obstet Gynecol.* 2017;6 (3):1040-4.
14. Mallick MP, Ray S, Medhi R, Bisai S. Elevated serum β -hCG and dyslipidemia in second trimester as predictors of subsequent Pregnancy Induced Hypertension. *Bangladesh Med Res Counc Bull.* 2015; 40(3):97-101.
15. Priya NK. Estimation of raised mid trimester β -hCG as predictor of PIH. *IOSR Journal of Dental and Medical Sciences (IOSR-JDMS).*2016; 15(12):40-43.
16. Yadav K, Aggarwal S, Verma K. Serum β -hCG and lipid profile in early second trimester as predictors of pregnancy induced hypertension. *J Obstet Gynaecol India.* 2014;64(3):169-74.
17. Uddin AW, Nessa S, Chowdhury S, Banu M. Hypertensive disorders of pregnancy and it's outcome in a tertiary care hospital. *J Armed Forces Med College, Bangla.* 2015;9(2):38-4
18. Kaur G, Jain V, Mehta S, Himani S. Prediction of hypertensive disorder of pregnancy by Maternal Serum β -hCG Levels in the Second Trimester (13–20 Weeks) of Pregnancy. *J Obstet Gynecol India.* 2012; 62(1):32-4.
19. Moslemizadeh N, Moslemizadeh KY. Serum β -hCG levels in diagnosis and management of preeclampsia. *J Med Sci.* 2008;8(8):722-7.
20. Silva LM, Coolman M, Steegers EA, Jaddoe VW, Moll HA, Hofman A, et al; low socioeconomic status is a risk factor for preeclampsia: th generation r study. *J Hypertens.* 2008;26(6):1200-8.
21. Basirat Z, Barat S, Hajiahmadi M. Serum beta human chorionic gonadotropin levels and preeclampsia. *Saudi Med. J.* 2006;27(7):1001-4.
22. Tebeu PM, Foumanae P, Mbu R, Fosso G, Biyaga PT, Fomulu JN. Risk factor for hypertensive disorder in pregnancy, Report from the Maroua Regional Hospital, Cameroon. *J Repord Infertil.* 2011; 12(3):227-34.
23. Sivakumar S, Vishnu Bhat B, Badhe BA. Effect of pregnancy induced hypertension on mothers and their babies. *Indian J Pediatr.* 2007;74(7):623-5.
24. Begum Z, Are I, Tanira S, Keya KA. The association between serum beta human chorionic gonadotropin and preeclampsia. *J Dhaka Med Coll.* 2015;23(1): 89-93.
25. Mamatha S, Singh S, Sujatha MS, Mahesh M. Comparative study of lipid profile in normotensive and hypertensive pregnant women. *Int j sci stud.* 2015;3(7):222-5.
26. Dayal M, Gupta P, Varma M, Ghose UK, Bhargava A. Evaluate the variations and potential clinical use of second trimester serum markers as predictor of preeclampsia. *J Obstet Gynecol India.* 2011; 61(1):38-41.

27. Choudhury KM, Das M, Ghosh S, Bhattacharya D, Ghosh TK. Value of serum β -hCG in pathogenesis of pre-eclampsia. *J Clin Gynecol Obstet.* 2012;1(4-5):71-5.
28. Kumari P, Sharma SN, Kumar S, Kumar MA. A comparative study of blood pressure in normal and pregnancy induced hypertensive cases for early diagnosis of hypertensive disorders in a tertiary care hospital. *Int J Sci Stud.*2014;2(3):33-7.
29. Vidyabati RK, Hijam D, Singh NK, Singh WG. Serum β -hCG and lipid profile in second trimester as predictors of pregnancy induced hypertension. *J Obstet Gynecol India.* 2010;60(1):44-50.
30. Pairu J, Bharathi KN, George K. Maternal and perinatal outcome in pregnancy induced hypertension and preeclampsia. *Int J Reprod Contracept Obstet Gynecol.* 2017;5(7):2166-70.
31. Fatemeh T, Marziyeh G, Nayereh G, Anahita G, Samira T. Maternal and perinatal outcome in nulliparous women complicated with pregnancy hypertension. *J Pak Med Assoc.* 2010;60(9):707.
32. Revankar VM, Narmada L. Assessment of serum β -hCG and lipid profile in early second trimester as predictors of hypertensive disorders of pregnancy. *Int J Gynecol Obstet.* 2017;138(3):331-4.
33. Soundararajan P, Muthuramu P, Veerapandi M, Mariyappan R. Serum beta human chorionic gonadotropin and lipid profile in early second trimester (14-20 weeks) is a predictor of pregnancy-induced hypertension. *Int J Reprod Contracept Obstet Gynecol.* 2016;5(9):3011-6.

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