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A HOSPITAL-BASED STUDY ASSESSING ASSOCIATION BETWEEN ELEVATED MATERNAL SERUM BETA HCG LEVELS AND HYPERTENSIVE DISORDERS OF PREGNANCY: AN OBSERVATIONAL STUDY

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ABSTRACT

Aim: The objective of the present study was to determine the association between elevated maternal serum β-hCG levels and HDP and role of serum β-hCG level as a diagnostic marker for early diagnosis of HDP.

Methods: This hospital-based observational research was carried out at the Obstetrics and Gynecology Department for a duration of 12 months. One hundred pregnant women with hypertensive disorders of pregnancy and one hundred pregnant women with normal blood pressure made up the study's case group. Both groups had their serum β-hCG levels tested and compared.

Results: Among the 100 hypertensive women who participated in the research, 20 had gestational hypertension, 22 had non-severe preeclampsia, 40 had severe preeclampsia, and 18 had antepartum eclampsia. Mothers with normotension in the control group had an average age of 25.85 years, whereas those with hypertension in the research group had an average age of 24.48 years. A statistically significant difference ($p<0.001$) was seen between the normotensive moms' mean blood pressure of 110.40±10.15 mmHg and the SBP mothers' mean blood pressure of 150.70±18.72 mmHg. Both the normal moms' mean diastolic blood pressure (DBP) of 75.5±5.50 mmHg and the hypertensive mothers' mean DBP of 105.66±12.48 mmHg were statistically significant ($p<0.001$). The amount of protein in the urine was found to vary significantly ($p<0.001$) between the two groups.

Conclusion: HDP cause considerable maternal and fetal death and morbidity, thus early identification and care may improve outcomes. Pregnancy-related hypertension was associated with greater serum β-hCG levels compared to normotensive women. The levels

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are also greater in severe preeclampsia patients than non-severe and in primigravid hypertensive women than multigravida.

Keywords: Eclampsia, Hypertensive disorders of pregnancy, Preeclampsia, Serum β-hCG

1. INTRODUCTION

The ultimate objective of safe motherhood is attained when a woman in good health delivers a healthy baby, with ideal timing and comprehensive preservation of the well-being of both the fetus and the mother throughout pregnancy, labor, and the postnatal period.[1] Nevertheless, a multitude of difficulties may occur during and during childbirth, greatly affecting the positive result of pregnancy. Hypertensive disorders of pregnancy are a complex and difficult collection of illnesses that contribute significantly to the overall burden of sickness in both developed and developing nations. Surprisingly, over 830 women lose their lives on a daily basis due to pregnancy-related problems that may have been avoided.[2]

Hypertensive diseases of pregnancy, such as gestational hypertension, preeclampsia, eclampsia, and chronic hypertension, continue to be unresolved challenges in the field of obstetrics, presenting a significant global public health concern. These conditions contribute to a high number of deaths and illnesses among pregnant women and their babies, and are a major reason for hospitalizations during pregnancy. According to the World Health Organization, hypertensive diseases during pregnancy continue to contribute to about 16% of maternal mortality, despite significant research efforts.[3] These diseases occur in around 5-10% of pregnancies worldwide, with variations depending on the locale. Hypertensive illnesses were responsible for 9% of maternal mortality in Africa and Asia, but in Latin America and the Caribbean, the percentage surpassed 25%. In India, the prevalence of this condition varies between 5-15%, with rates of 16-20% for women experiencing their first pregnancy (primigravida) and 7-10% for women who have had many pregnancies (multigravida). Hypertensive diseases during pregnancy provide distinct difficulties, remaining as feared risks despite advancements in treatment for both the mother and newborn.[4]

An ongoing goal of obstetricians is to detect and anticipate the hazards linked to pregnancy, enabling prompt preventive measures. Several variables lead to the development of pre-eclampsia, such as advanced maternal age, having no prior pregnancies, a history of pre-eclampsia in past pregnancies, carrying numerous babies, using assisted reproductive procedures, and certain pre-existing medical disorders and dietary factors. The range of hypertensive diseases during pregnancy varies from slightly increased blood pressures with no clinical importance to severe hypertension and malfunction of many organs.[5] The American College of Obstetricians and Gynecologists (ACOG) has categorized hypertensive diseases of pregnancy into four groups: prenatal hypertension, preeclampsia/eclampsia, preeclampsia superimposed on chronic hypertension, and chronic hypertension. This classification helps in diagnosing and managing these conditions. Every group has distinct diagnostic criteria that are determined by blood pressure levels, proteinuria, organ involvement, and other clinical signs.[6]

ISSN: 0975-3583, 0976-2833 VOL14, ISSUE12, 2023

The aim of this research was to investigate the link between increased levels of maternal blood β-hCG and hypertensive disorders of pregnancy (HDP). Additionally, we aimed to assess the relationship between serum β-hCG levels and the severity of preeclampsia, as well as examine the potential of serum β-hCG levels as a diagnostic marker for early detection of HDP.

2. MATERIALS AND METHODS

This hospital-based observational research was carried out at the Obstetrics and Gynecology Department for a duration of twelve months. 100 pregnant women with hypertensive disorders of pregnancy and one hundred pregnant women with normal blood pressure made up the study's case group. Both groups had their serum β-hCG levels tested and compared.

Inclusion criteria

Study group: This included 100 pregnant women with gestational age more than 20 weeks, fulfilling the criteria as any of the following three subgroups;

• Gestational hypertension: Pregnant women with gestational age more than 20 weeks with blood pressure, systolic ≥140 mmHg and diastolic ≥90 mmHg with no proteinuria.

• Preeclampsia (non-severe and severe): Pregnant women with gestational hypertension with proteinuria and imminent symptoms like headache, epigastric pain, thrombocytopenia, altered renal function test, elevated liver enzymes, pulmonary edema.

• Eclampsia: Preeclamptic women with convulsions.

Control group: This included 50 pregnant women with gestational age more than 20 weeks, who were normotensive with blood pressure, systolic <140 mmHg and diastolic <90 mmHg.

Exclusion criteria

Pregnant women more than 20 weeks of gestation with

• Multiple pregnancies

• Gestational diabetes mellitus

• Medical disease like chronic hypertension, chronic renal disease, chronic liver disease, cardiac disease, SLE or hematological disorders.

A thorough evaluation was done including a detailed history, physical examination (general and systemic) to confirm the above-mentioned inclusion and exclusion criteria. A written informed consent was taken after explaining the procedure about measurement of blood pressure, taking of urine samples for proteinuria, collection of blood sample for serum β-hCG.

Measurement of blood pressure

A mercury sphygmomanometer was used for the purpose of measuring blood pressure. A cuff of suitable dimensions (1.5 times the upper arm circumference or a cuff with a bladder that covers 80% or more of the arm) was employed. The patients were positioned upright, with their right arm horizontally supported at heart level, following a rest period of at least 10 minutes. Additionally, the cuff was used when the patient was lying on their left side, with the arm at heart level. In pregnancy, diastolic blood pressure was assessed based on the cessation of sound (Korotkoff phase V) rather than the dampening of sound (Korotkoff phase

ISSN: 0975-3583, 0976-2833 VOL14, ISSUE12, 2023

IV). This method is more reliable and has a stronger association with the actual diastolic blood pressure. In cases when the presence of KV is lacking, the acceptance of KIV was granted.

Assessment of proteinuria

Visual dipstick test was used to measure proteinuria.

Blood sample collection

Approximately 3 ml of venous blood samples were taken using aseptic precautions and placed in a test tube. The sample was collected for 2 hours and then centrifuged at a speed of 3000 revolutions per minute for a duration of 5 minutes. The serum was isolated and collected in a polythene tube with a cork stopper. The sera that showed no evidence of hemolysis were used for the determination of β-hCG. Analysis of biological substances at the molecular level. The concentration of serum β-hCG was determined using a solid-phase, two-site chemiluminescence immunoassay (CLIA). The authors used a fully automated enzyme amplified chemiluminescent immunoassay using the Immulite 1000 analyzer.

Statistical analysis

Proper template for data entry was generated on MS Excel and data was entered on this template. The data was compiled and subjected to analysis using statistical package for social sciences (SPSS) and interpreted according to the type of variables. 5% level of significance ($p<0.05$) was considered for the study.

3. RESULTS

Table 1: Patient details

Study group	N%
Gestational hypertension	20 (20)
Non- severe preeclampsia	22 (22)
Severe preeclampsia	40 (40)
Antepartum eclampsia	18 (18)

Out of the 100 hypertensive women in the study group, there were 20 (20%) patients with gestational hypertension, 22 (22%) with non-severe preeclampsia, 40 (40%) with severe preeclampsia and 18 (18%) with antepartum eclampsia. The mean age of normotensive mothers in control group was 25.85 years and that of hypertensive mothers in the study group was 24.48 years.

Table 2: Comparison between study group (hypertensive) and control (normotensive) mothers group in respect to parity and Systolic and diastolic blood pressure and proteinuria

Gravida	Normotensives (n=50)	Hypertensives (n=100)	Total (n=150)	P value
	N %	N %	N %	
Primi	22 (44)	56 (56)	78 (52)	p=0.01
Multi	28 (56)	44 (44)	72 (48)	
Total	50	100	150	

ISSN: 0975-3583, 0976-2833 VOL14, ISSUE12, 2023

Blood pressure				
	Mean±SD	**Mean±SD**		
SBP (mm Hg)	110.40±10.15	150.70±18.72		p<0.001
DBP (mm Hg)	75.5±5.50	105.66±12.48		p<0.001
Proteinuria				
	N %	**N %**	**N %**	
Absent	39 (78)	20 (20)	59 (39.34)	P < 0.001
Present	11 (22)	80 (80)	91 (60.66)	
Total	50	100	150	

The difference in parity of mothers was statistically significant (p<0.05) with a greater number of primigravida in the study (hypertensive) group as compared to control (normotensive) women. The mean of SBP mothers with HDP was 150.70±18.72 mmHg and that of normotensive mothers was 110.40±10.15 mmHg which was statistically significant (p<0.001). The mean DBP of hypertensive mothers was 105.66±12.48 mmHg and that of the normal mothers was 75.5±5.50 mmHg which was also statistically significant (p<0.001). It was observed that there was statistically significant difference (p<0.001) in the presence of proteinuria between the two groups.

Table 3: Distribution of cases according to gestational age

Gestational age	**Normotensives (n=50)**	**Hypertensives (n=100)**
20W OD-27W 6D	1 (2)	3 (3)
28W-31W 6 0D	2 (4)	6 (6)
32W-36W 6 OD	10 (20)	44 (44)
37W-40W 6 OD	35 (70)	46 (46)
41W OD & ABOVE	2 (4)	1 (1)
Mean±SD	37.3±2.7	36.4±3.6

The difference in gestational age between the two groups was statistically significant (p<0.05). Mean gestational age was 37.3±2.7 weeks in the normotensive group and 36.4±3.6 weeks in the hypertensive group.

Table 4: Comparison of serum β-hCG between non-severe preeclamptic and severe preeclamptic mothers

β-hCG (IU/L)	**Non-severe preeclampsia(n=22)**	**Severe preeclampsia (n=40)**	**Significance**
Mean	34422.32	60050.34	p<0.001
SD	24987.74	2754.31	
Median	33456.5	67076	

The mean serum β-hCG level of severe preeclamptic mothers was higher than non-severe preeclamptic mothers.

ISSN: 0975-3583, 0976-2833 VOL14, ISSUE12, 2023

Table 5: Comparison of serum levels of β-hCG in primigravida and multigravida women

Serum β- hCG (IU/L)	Primigravida (n=78)		Multigravida (n=72)	
	Normotensives (n=23)	Hypertensives (n=55)	Normotensives (n=28)	Hypertensives (n=44)
Mean	18065.15	52820.15	17030.08	49050.1
SD	16740.90	29550.77	16590.06	30440
Median	13999.5	55350.6	10444	45026

Among primigravida, the difference in β-hCG levels between control (normotensives) and study (hypertensives) mothers was statistically significant ($p<0.001$). Similarly, among multigravida, the difference was statistically significant ($p<0.001$) with higher levels of β-hCG in hypertensive mothers. When comparing the β-hCG levels between primi and multigravid in control group (normotensives) there was no significant difference ($p>0.05$). There was statistically significant difference ($p<0.05$) between β- hCG levels of primi and multigravid of the study group (hypertensives) with higher levels in the primigravida patients.

Table 6: Comparison of serum β-hCG levels between different categories of hypertensive disorders of pregnancy

Serum β-hCG (IU/L)	Gestational hypertension (n=20)	Non-severe preeclampsia (n=22)	Severe preeclampsia (n=40)	Antepartum eclampsia (n=18)
Mean	20920.28	36520.36	60030.34	70250.46
SD	10690.29	23569.74	28720.31	23638.03
Median	19220	32420.5	67090	74130

It was seen that there was a significant difference between the different categories of HDP ($p<0.05$).

4. DISCUSSION

Hypertensive disorders of pregnancy (HDP) continue to be a perplexing unresolved issue in the field of obstetrics. The mechanism by which pregnancy triggers or worsens hypertension remains unresolved despite extensive research efforts spanning many decades. Despite advancements in obstetrical and neonatal care, the capacity to accurately anticipate hypertension diseases has not shown considerable progress, despite the decrease in associated illness and death. In India, the occurrence rate of hypertensive disorders in pregnancy was 7.8%, with preeclampsia affecting 5.4% of the studied population.[7] The occurrence of eclampsia in industrialized nations is around 1 in 2000 births, but in poor countries, it is believed to be around 1 in 100 to 1 in 1700 instances.[8,9]

Among the 100 women with high blood pressure in the research, 20% had gestational hypertension, 22% had non-severe preeclampsia, 40% had severe preeclampsia, and 18%

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had antepartum eclampsia. The average age of moms without hypertension in the control group was 25.85 years, whereas the average age of mothers with hypertension in the study group was 24.48 years. Research conducted by Begum Z et al, Basirat et al, Choudhury et al, also demonstrates consistent findings, indicating that there is no notable association between maternal age and the occurrence of hypertension in both hypertensive and normotensive groups.[10-12] Nevertheless, Mujawar et al. noted a substantial disparity in maternal age across the groups ($p<0.05$), with the control group having a mean age of 26.4±4.48 years and the preeclampsia group having a mean age of 23.6±4.16 years.[13]

The disparity in parity across mothers was found to be statistically significant ($p<0.05$), with a higher proportion of first-time moms seen in the hypertension study group compared to the normotensive control group. In the research conducted by Kaur G et al, similar findings were seen. The incidence of pregnancy-induced hypertension (PIH) was higher among primigravida women, with 17% having PIH, compared to 7.14% among multigravida women. However, no statistically significant correlation was found.[14] The disparity in gestational age between the two groups exhibited statistical significance ($p<0.05$). The average gestational age was 37.3±2.7 weeks in the group without high blood pressure and 36.4±3.6 weeks in the group with high blood pressure. The research conducted by Al-bayati MM et al found that the average gestational age for normotensive women was 37.11±1.98 weeks, whereas hypertension moms had an average gestational age of 35.72±1.93 weeks. This difference was statistically significant ($p<0.001$).[15] The average systolic blood pressure (SBP) of women with hypertensive disorders of pregnancy (HDP) was 150.70±18.72 mmHg, whereas the average SBP of mothers without hypertension was 110.40±10.15 mmHg. This difference in SBP between the two groups was statistically significant ($p<0.001$). The average diastolic blood pressure (DBP) of hypertensive moms was 105.66±12.48 mmHg, whereas that of normal mothers was 75.5±5.50 mmHg. This difference was statistically significant ($p<0.001$), which aligns with the results of previous investigations.[16,17]

The average blood β-hCG level of moms with severe preeclampsia was greater than that of mothers with non-severe preeclampsia. The investigations conducted by Begum Z et al and Mujawar et al observed similar findings, with the case group of preeclampsia showing elevated levels of blood β-hCG.[12-14] The β-hCG levels in primigravida women were significantly different between control (normotensive) and study (hypertensive) moms ($p<0.001$). Similarly, there was a statistically significant difference ($p<0.001$) in the levels of β-hCG among multigravida, with hypertensive women having greater amounts. When comparing the β-hCG levels between primigravidae and multigravidae in the control group (normotensives), no statistically significant difference was observed ($p>0.05$). A statistically significant difference ($p<0.05$) was seen in the β-hCG levels between primigravida and multigravida individuals in the study group (hypertensives), with greater levels found in the primigravida patients. Research conducted by Mooney RA et al revealed a decline in maternal blood hCG levels as parity increased. The decline in hCG levels exhibited a consistent pattern throughout each week of gestation, especially between weeks 15 and 20. Parity has no impact on MSAFP and MSAFP MoM.[18]

In a study conducted by Singh A et al (2016), it was shown that the levels of serum βHCG

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were considerably greater in participants with pregnancy-induced hypertension (41500 ± 14000 mIU /ml) compared to healthy pregnant control subjects (22500± 4500 mIU /ml). In this case, the elevated production of βHCG was caused by either aberrant placental invasion or placental immaturity.[19] In comparable research, Nandini et al (2014) found that the serum βHCG level was substantially higher in women who had PIH (65315 ± 10237 mIU /ml) compared to healthy pregnant control individuals (26088 ± 11391 mIU /ml) with a p-value of less than 0.001.[20]

5. CONCLUSION

Early identification of hypertensive disorders of pregnancy (HDP) may significantly reduce maternal and fetal mortality and morbidity. This is achieved by providing adequate therapy, which improves maternal and perinatal outcomes. The serum β-hCG level was elevated in women with hypertensive disorders of pregnancy compared to those who were normotensive. The levels are elevated in severe preeclampsia patients compared to non-severe preeclampsia patients, and in primigravid hypertension women compared to multigravida hypertensive women. Hence, assessing the blood β-hCG levels may aid in the prompt detection of HDP and also act as a gauge for the severity of the condition. Therefore, more research is necessary on a larger group of patients to validate the importance of blood β-hCG as a screening test for hypertensive disorders of pregnancy (HDP).

6. REFERENCES

1. Health Organization. Maternal mortality, 2019.
2. Steegers EA, Von Dadelszen P, Duvekot JJ, Pijnenborg R. Pre-eclampsia. Lancet. 2010;376(9741):631-44.
3. Sibai B, Dekker G, Kupferminc M. Pre-eclampsia. Lancet. 2005;365(9461):785-99.
4. Poon LC, Kametas NA, Maiz N, Akolekar R, Nicolaides KH. First-trimester prediction of hypertensive disorders in pregnancy. Hypert. 2009;53(5):812-8.
5. American College of Obstetricians and Gynecologists. Hypertension in pregnancy: Report of the American College of Obstetricians and Gynecologists' Task Force on Hypertension in Pregnancy. Obstet Gynecol. 2019;133(1):e1-e25.
6. Duley L. The global impact of pre-eclampsia and eclampsia. InSeminars in perinatology. Vol. 33. WB Saunders; 2009:130-137.
7. Long PA, Oat JN. Preeclampsia in twin pregnancy: severity and pathogenesis. Aust NZ J Obstet Gynecol. 1987;27:1-5.
8. Curry SL, Hammond CB, Tyrey L, Creasman WT, Parker RT. Hydatidiform mole: diagnosis, management and long term follow up of 374 patients. Obstet Gynecol. 1975;45:1-8.
9. Sajith M, Nimbargi V, Modi A, Sumariya R, Pawar A. Incidence of pregnancy induced hypertension and prescription pattern of antihypertensive drugs in pregnancy. Int J Pharma Sci Res. 2014;23:4.

ISSN: 0975-3583, 0976-2833 VOL14, ISSUE12, 2023

10. Misra R, Donald's I. Practical Obstetrics problems; 6th edition; Oracle BI publisher. 2006;14:300-1.
11. Chua S, Arulkumaran S, Eclampsia-no room for complacency. Singapore Med J. 1995;36:470-1.
12. Begum Z, Ara I, Tanira S, Keya K. The association between serum beta-human chorionic gonadotropin and preeclampsia. J Dhaka Med Coll. 2014;23(1):89- 93.
13. Basirat Z, Barat S, Hajiahmadi M. Serum beta human chorionic gonadotropin levels and pre- eclampsia. Saudi Med J. 2006;27(7):1001-4.
14. 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.
15. Mujawar SA, Patil VW, Daver RG. Serum human chorionic gonadotropin as a biochemical marker of adverse pregnancy outcome in severe preeclampsia. Am J Biochem. 2018;8(1):13-7.
16. Kaur G, Jain V, Mehta S, Himani S. Prediction of PIH by maternal serum beta HCG levels in the second trimester (13-20 weeks) of pregnancy. The J Obstet Gynecol India. 2012;62(1):32-4.
17. Al-bayati MM, Hammod NJ. Elevated serum β-hCG levels in severe pre-eclampsia. Iraqi J Med Sci. 2009;7(1):96-101.
18. Mooney RA, Arvan DA, Saller DN, French CA, Peterson CJ. Decreased maternal serum hCG levels with increasing gravidity and parity. Obstet Gynecol. 1995;86:900-5.
19. Akansha Singh, Poonam Khambra, K Usha Rani, Ashish Kumar Mandal. Assessment of serum βhCG, lipid profile and uric acid levels in early second trimester as predictors of pregnancy induced hypertension.. Annals of Pathology and Laboratory Medicine,2016;3(3) : A157-161. ISSN 2349 – 6983.
20. Nandini et al. study on Beta HCG, Prolactin and Lipid Profile in Pregnancy induced Hypertension in second trimester of pregnancy 2012; J ObstetGynaecol India ;64(3):169-74.