



EVALUATION OF SERUM β hCG AND SERUM CREATININE AMONG PREGNANT WOMEN WITH AND WITHOUT PREECLAMPSIA

Biochemistry

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ABSTRACT

Preeclampsia is a metabolic disorder that adversely affects the maternal and the fetal life. There are multiple theories that suggest that preeclampsia is a placental disorder. It causes renal complications and it is very important for the diagnosis of renal complications at a very early stage. But the studies related to it are very few. Therefore this study is taken up to evaluate parameters like serum β hCG and serum creatinine among the pregnant women with and without preeclampsia.

KEYWORDS

INTRODUCTION :

Pre eclampsia is a pregnancy related disorder characterized by hypertension and proteinuria noticeable anytime after 20 weeks of gestation.¹ The diagnosis is made using two cardinal features in previously normotensive and non proteinuric women (1) Blood pressure $\geq 140/90$ mmHg and (2) Proteinuria ≥ 300 mg per 24 h urine collection.² It is a leading cause of maternal and fetal mortality and morbidity worldwide.¹ Preeclamptic women and children born from pre eclamptic pregnancies are at greatest risk to develop severe cardiovascular complications and metabolic syndromes later in life. India, despite being a fast developing country, is still far behind in achieving the required maternal mortality rates as per Millennium Development Goals set by World Health Organization. The incidence of pre eclampsia in India is reported to be 8-10% among pregnant women.³ The neonatal mortality is around 43 per 1000 live births.⁴

The current knowledge about the prediction of preeclampsia is wide. A new first trimester screening algorithm has been developed and validated to predict preterm preeclampsia. It combines mean arterial blood pressure and Doppler Ultrasound.⁴ Apart from these investigations, research is being undertaken by the professionals for the investigation of various biochemical markers for the evaluation of preeclampsia.

The human chorionic gonadotropin (hCG), synthesized from syncytiotrophoblastic cells of placenta, is a glycoprotein made up of two non covalently linked subunits, α and β . It peaks in the maternal serum by 8-10 wks of gestational age and then slowly decreases to reach a plateau at 18-20 weeks of gestation. There are multitudes of hypotheses postulated to understand the mechanism of pregnancy induced hypertension which all points towards early placental abnormalities. Human placenta synthesizes protein, steroids, and glycoprotein hormones throughout the pregnancy and it has been proclaimed as a disorder of trophoblastic cells. Despite major research, still the placental pathogenesis is not clearly understood and explained.⁵

Preeclampsia is more common in women with an underlying kidney disease. On the other hand, it has been suggested that preeclampsia itself increases the risk of kidney disease later in life.⁶ So it is important to know the role of renal parameters in the pathogenesis of preeclampsia. But the studies which have been done to evaluate their role in preeclampsia are very few. Considering the importance of these parameters in preeclampsia and limited findings in the current evidence, the relationship between serum β hCG and serum creatinine in patients with preeclampsia needs further investigation.

Therefore this study is taken up to evaluate parameters like serum β hCG and serum creatinine among the pregnant women with and without preeclampsia.

Aims And Objectives :

1. To estimate serum β -hCG and serum creatinine among pregnant women with and without preeclampsia
2. To compare serum β -hCG and serum creatinine among pregnant

women with and without preeclampsia.

3. To determine the correlation between serum β -hCG and serum creatinine among pregnant women with preeclampsia

Method :

This case control study was conducted at Clinical Biochemistry Laboratory in ESIC Medical College PGIMSR and Model Hospital, Rajajinagar, Bangalore from January 2023 to July 2024 over a period of 1.5 years.

Inclusion Criteria :

The cases were pregnant women in the age group of 18 - 45 years diagnosed with preeclampsia as per ACOG criteria with Blood Pressure $\geq 140/90$ mmHg and proteinuria ≥ 300 mg per 24 hours urine collection, more than 20 weeks gestation, attending the OPD and admitted in the wards of OBG department of ESIC Model hospital. Controls include pregnant women in the age group of 18 - 45 years more than 20 weeks of gestation who are normotensive, attending the OPD of OBG department. Both cases and controls who have given informed consent were included in the study.

Exclusion Criteria :

1. Patients who were not willing to give informed consent.
2. Patients with severe anemia
3. Patients who were previously diagnosed with chronic hypertension
4. Multiple pregnancy
5. Patients with chronic kidney disease, ischemic heart disease, chronic liver disease

After obtaining approval and clearance from the Institutional Ethical Committee, the control and the patient group were enrolled for the study after obtaining informed consent. Information such as history, clinical findings, report of routine blood investigations were obtained from the clinical case files and documented in case record proforma.

Under aseptic precautions 5 ml of venous blood was drawn, and then transferred to plain sterile vacutainer tubes, blood was allowed to clot at 37 degree C, then centrifuged at 3000 rpm for 10 minutes to separate the serum, the sera thus separated was transferred to plain bullet vials and used for analysis of serum β hCG and serum creatinine in the Clinical Biochemistry Laboratory of ESIC MC & PGIMSR Model Hospital, Bangalore.

Serum β hCG levels was analyzed by CLIA method using fully automated Access 2 analyzer from Beckman Coulter and serum creatinine by modified Jaffe's method using fully automated DxC 700 AU analyzer from Beckman Coulter, for which Internal and External Quality Assurance Programmes are maintained.

Statistical Analysis :

All the data collected were entered and compiled using Microsoft Excel. The qualitative variables were presented in frequency with percentage. The quantitative variables were presented in mean $\pm$ SD and median with interquartile range. To compare between two groups,

normality test T test or Mann Whitney U test were used. To find the correlation between two continuous variables based on normality test Karl Pearson test or Spearman Rank Test were used. Data was analyzed using statistical software SPSS 5.

RESULTS:

50 cases and 50 controls were enrolled in the study during their second and third trimester of pregnancy. Mean age of preeclampsia patients and normotensive controls were 25.88 ± 3.61 and 23.46 ± 1.99 respectively. In the current study, there is no significant difference in the mean values of BMI among the cases and controls which was 24.73 ± 3.90 and 23.66 ± 3.99 . There is significant difference in the mean values of systolic blood pressure, diastolic blood pressure, serum β hCG and serum creatinine among cases and controls.

Table 1 : Demographic and clinical characteristics of the study participants

Sl No.	Parameters	No	Cases (N = 50)	Control (N = 50)	P-value
1	Mean age in years	100	25.88 ± 3.61	23.46 ± 1.99	<0.001
2	Gestational age in weeks	100	25.64 ± 1.76	25.36 ± 1.79	0.09
3	BMI (kg/m ²)	100	24.73 ± 3.90	23.66 ± 3.99	0.07
3	SBP in mmHg	100	146.52 ± 6.14	120.04 ± 6.79	<0.001
4	DBP in mmHg	100	96.12 ± 3.30	79.4 ± 4.27	<0.001
5	Serum β hCG in mIU/ml	100	55485.74 ± 9978.45	36566.99 ± 9194.64	<0.001
6	Serum Creatinine in mg/dl	100	1.03 ± 0.84	0.70 ± 0.12	<0.001

Serum β hCG:

Mean serum β hCG level of preeclampsia patients and normotensive patients were 55485.75 ± 9978.45 and 36566.99 ± 9194.64 respectively. There is a significant increase in mean β hCG level of preeclampsia patients compared to normotensive patients ($p < 0.0001$).

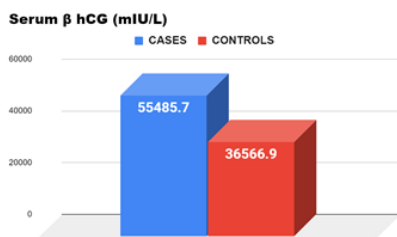


Figure 1 : Serum β hCG level in cases and controls

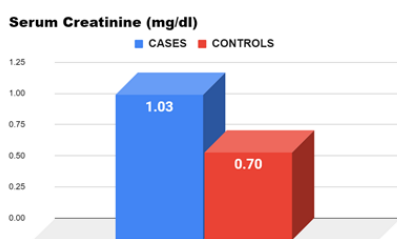


Figure 2 : Serum β hCG level in cases and controls

Blood Pressure And Serum β hCG:

There is a high positive correlation between Blood Pressure and Serum β hCG in the preeclampsia patients
 R value = 0.82 (SBP Vs Serum β hCG)
 R value = 0.83 (DBP Vs Serum β hCG)

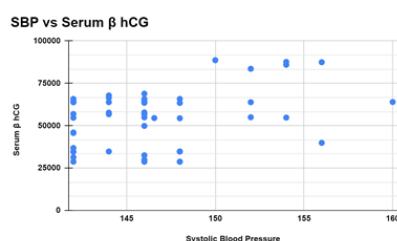


Figure 3 : Correlation between SBP and serum β hCG

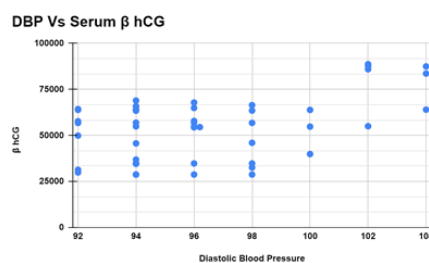


Figure 4 : Correlation between DBP and serum β hCG

Blood Pressure And Serum Creatinine :

There is a strong positive correlation between Blood Pressure and Serum Creatinine level in the preeclampsia patients
 R value = 0.90 (SBP Vs Serum Creatinine)
 R value = 0.85 (DBP Vs Serum Creatinine)

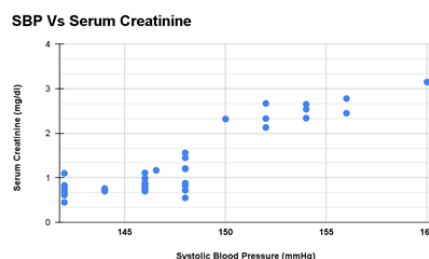


Figure 5 : Correlation between SBP and Serum Creatinine

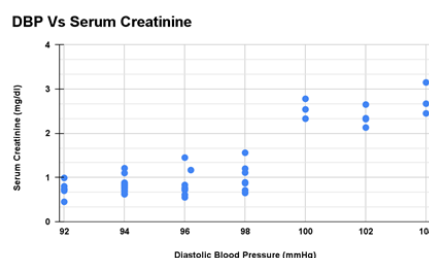


Figure 6 : Correlation between DBP and Serum Creatinine

Serum β hCG and Serum Creatinine :

There is a positive correlation between serum β hCG and Serum Creatinine levels in the preeclampsia patients with the R value of 0.73

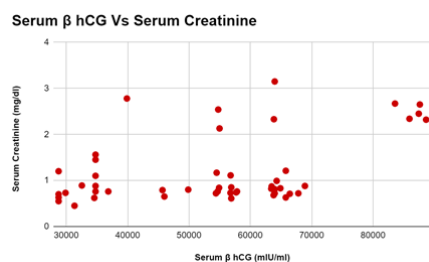


Figure 6 : Correlation between serum β hCG and Serum Creatinine

DISCUSSION :

Preeclampsia is a disease that affects women in pregnancy. It increases the risk of obstetric complications such as placental abruption, premature labor, eclampsia and HELLP syndrome. It can also lead to glomerular endothelial damage causing decrease in glomerular filtration rate. Glomerular endotheliosis is a term used to describe the ultrastructural changes of glomeruli which include swelling and vacuolization of the endothelial cells and loss of capillary space.¹ Electron microscopy shows loss of glomerular endothelial fenestra which leads to 40% reduction in glomerular filtration rate. In recent years it is found that a mild amount of glomerular endotheliosis can occur in normal pregnancy. This finding suggests that the endothelial dysfunction of preeclampsia may be an exaggeration of the normal

physiological process that occurs near the end of the pregnancy.

In our current study we noticed a significant increase in serum creatinine level in the preeclampsia groups compared to the control group.

Our results are in line with Ekun OA et. al., that showed which the serum creatinine levels were significantly raised in the preeclamptic population compared to normotensive patients.⁷ Vyakaranam S. Bhongir et al. reported an increase in the mean creatinine values in preeclampsia compared to pregnancy induced hypertension with the value <0.001 .⁸

In contrast to our findings, Manjareeka. M. et. al concluded that the differences in the mean serum creatinine concentration between the preeclampsia and control groups were not statistically significant, and this parameter has limited utility in the prediction of preeclampsia.⁹ There was no significant difference in serum creatinine level between preeclampsia and normotensive patients according to Charles et. al.¹⁰ In their research, Egwuatu VE et. al and Abdulmenum et. al. found that modest change in serum creatinine level in pre eclampsia and normotensive patients are inconsequential.¹¹

β hCG is a placental product primarily produced by syncytiotrophoblast. It peaks in the maternal serum by 8-10 wks of gestational age and then slowly decreases to reach a plateau at 18-20 weeks of gestation. Elevated levels of β hCG indicate poor placental perfusion which can be caused due to preeclampsia.¹² Mean levels of β hCG in normotensive and preeclampsia groups were 36566.99 ± 9194.64 and 55485.75 ± 9978.45 respectively ($p < 0.0001$). Our study was consistent with that of Vidyapathi et al. who in their study showed that there was increased β hCG levels in preeclampsia patients compared to non preeclampsia patients.¹³ Siberie et. al concluded that maternal serum free β hCG concentration at 10-14 weeks was not significantly different between normotensive persons and those that developed preeclampsia.¹⁴ In pregnancy, lower oxygen tension in the first trimester prevents trophoblast from differentiating towards an invasive phenotype and this mechanism is mediated by TGF β . In preeclampsia placenta, TGF β levels remain high and the trophoblast is arrested at an immature state while its invasiveness is reduced. As β hCG is produced by placenta, the levels of β hCG are high due to trophoblastic abnormality.¹⁵

Our study has limitations. First, the current study is only limited on these diagnostic markers such as serum β hCG and serum creatinine. Therefore, since variations are inevitable for each trimester with several diagnostic markers, working on additional parameters in all three trimesters are required. Second, our study is an Institutional based case control study that is merely a prediction of associations. Therefore a multicentre prospective study with a larger population can give a better finding.

CONCLUSION:

Our study shows a significant increase in serum creatinine in the preeclampsia patients compared to normotensive patients. On correlating the Blood Pressure with serum creatinine we can see a positive correlation i.e., as the Blood Pressure increases serum creatinine levels also increases. Furthermore, serum creatinine level increases with increase in serum β hCG. Therefore renal function should be routinely monitored in patients with preeclampsia. As preeclampsia is a disease of multiorgan involvement, a thorough and proper understanding of its pathophysiology and pathogenesis is indeed needed to efficiently manage the patient. A combination of the assessment of serum β hCG and renal parameters like serum urea, serum creatinine and serum uric acid along with the conventional approach with meticulous examination and relevant investigations can prevent maternal as well as perinatal mortality.

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