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Original Research Article

Correlation of serum C-reactive protein level with severity of preeclampsia

Syed W. Hussain*, Mauchumi S. Pathak

Department of Biochemistry, Gauhati Medical College and Hospital, Guwahati, Assam, India

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***Correspondence:**
Dr. Syed W. Hussain,
E-mail: washbir97@gmail.com

ABSTRACT

Background: Preeclampsia is a hypertensive disorder unique to pregnancy, characterized by elevated blood pressure and proteinuria after 20 weeks of gestation. It is associated with systemic inflammation and generalized endothelial dysfunction. C-reactive protein (CRP), a sensitive marker of inflammation, has been implicated in the pathophysiology of preeclampsia. This study aims to assess serum CRP levels in preeclamptic women and determine its correlation with disease severity.

Methods: A case-control study was conducted over a two-month period at the department of biochemistry and department of obstetrics and gynaecology, Gauhati medical college and hospital. A total of 60 pregnant women were enrolled-30 preeclamptic patients (15 mild, 15 severe) and 30 normotensive pregnant controls-based on strict inclusion and exclusion criteria. Serum CRP levels were measured using the Vitros 5600 integrated system. Data were analyzed using the independent t test and Pearson's correlation coefficient. A $p<0.05$ was considered statistically significant.

Results: The mean serum CRP level in preeclamptic patients was significantly higher (14.63±1.99 mg/l) than in normotensive controls (5.98±1.86 mg/l) ($p<0.001$). Among the preeclamptic group, severe cases had significantly higher CRP levels (16.23±1.06 mg/l) compared to mild cases (13.03±1.28 mg/l) ($p<0.001$). CRP levels showed a strong positive correlation with both systolic and diastolic blood pressures (DBP) in both mild ($r=0.97$ and $r=0.98$, respectively) and severe ($r=0.95$ and $r=0.93$, respectively) preeclampsia groups.

Conclusions: Serum CRP levels are elevated in preeclampsia compared to normal pregnancy and increase further with disease severity.

Keywords: Preeclampsia, C-reactive protein, Hypertensive disorders of pregnancy, Inflammation, Biomarkers, Disease severity

INTRODUCTION

Preeclampsia is one of the hypertensive disorders in pregnancy.[1] Preeclampsia is characterized by an increase in systolic blood pressure (SBP) >140 mmHg and diastolic >90 mmHg accompanied by proteinuria >30 mg/liter of urine or 300 mg/24 hours and occurs after about 20 weeks of gestation.[2] Preeclampsia is related to the failure of trophoblast invasion of maternal spiral arteries, which causes an increase in uterine artery vascular resistance, thereby reducing uteroplacental blood flow.[3] Preeclampsia is also associated with generalized endothelial dysfunction. The etiology of endothelial dysfunction in preeclampsia is not known, but it has been postulated to be part of an exaggerated maternal inflammatory response to pregnancy.[4] Several studies indicate that there is a role of systemic inflammation in the development of preeclampsia, which involves proinflammatory cytokines, such as interleukin 6 and tumor necrosis factor alpha. An increase in proinflammatory cytokines is also reported to stimulate production of CRP, a protein produced during a systemic inflammatory reaction, a sensitive and objective

marker of inflammation. CRP is one of the acute phase reactants in humans.[5,6] It is an important first-line defense molecule, as it activates the complement system and mediates the phagocytic clearance of pathogens and damaged cells. This study is undertaken to find the correlation between serum CRP level and severity of preeclampsia.

METHODS

Materials and methods

A case-control study was carried out to find the CRP concentrations among normotensive and preeclamptic patients attending the outpatient department of the department of obstetrics and gynaecology of Gauhati medical college and hospital for a period of 2 months from November 2024 to January 2025. Based on inclusion and exclusion criteria, a total of 60 pregnant women were selected for the study. The study included group A cases (30) and group B controls (30). Group A consisted of 30 preeclamptic patients (15 mild and 15 severe). Group B consisted of 30 normotensive pregnant women with gestational age more than 20 weeks.

Inclusion criteria

Cases include diagnosed cases of preeclampsia with gestational age more than 20 weeks. Controls include normal pregnancies with gestational age more than 20 weeks were included.

Exclusion criteria

Patients with a history of chronic renal disease, chronic hypertension, preexisting diabetes or gestational diabetes, cardiovascular illness, premature rupture of membranes, urinary tract infections, patients with signs of labor or use of labor induction, and smokers were excluded.

Data collection

All the patients enrolled in the study were interviewed using a standard interview schedule after their verbal and written consent.

Methodology

Two ml of venous blood was collected from the antecubital vein under full antiseptic conditions using a plastic disposable syringe. Serum was separated within half an hour and stored at -20°C till analysis was done. Serum CRP level was estimated using the Vitros 5600 integrated system.

Principle

The immunorate format for CRP is based on an enzymatic, heterogenous sandwich immunoassay format.

Statistical analysis

Categorical variables were presented in percentage (%) and number. Continuous variables were presented as median and mean±SD, and the Kolmogorov-Smirnov test was used to check the normality of data. Between the two groups, quantitative variables were compared using an independent t-test. The association of blood pressure and CRP was assessed by the Pearson correlation coefficient. Data was considered statistically significant if $p<0.05$. The data was entered in an MS excel spreadsheet, and analysis was done with GraphPad software.

Normal reference value of CRP: 0-10 mg/L for statistical analysis, an independent t test was applied to assess the statistically significant differences in parameters between the cases and controls. Coefficient of correlation: To see the correlation between two variables, the coefficient of correlation (r) is applied. If r is near +1, it indicates a strong positive correlation. A value on the minus side indicates inverse correlation. If r=0, it indicates no correlation. The significance of the correlation coefficient was tested by t-test.

RESULTS

The mean level of serum CRP in group A (cases) was 14.63±1.99 mg/l, and that in the control group B was 5.98±1.86 mg/l. The difference in serum CRP level between preeclamptic and normal women was found to be highly significant. ($p<0.001$) (Table 2).

The mean level of serum CRP in mild preeclamptic patients was 13.03±1.28 mg/l. The mean level of CRP in severe preeclamptic women was 16.23±1.06 mg/l. The difference in serum CRP level between mild and severe preeclamptic patients was found to be highly significant. ($p<0.001$) (Table 3).

A significant positive correlation was found between serum CRP level and blood pressure (systolic and diastolic) in mild preeclampsia patients (Table 4).

A significant positive correlation was found between serum CRP level and blood pressure (systolic and diastolic) in severe preeclampsia patients (Table 5).

A positive correlation was observed between SBP and CRP level in mild preeclampsia (Figure 1).

A positive correlation was observed between DBP and CRP level in mild preeclampsia (Figure 2).

A positive correlation was observed between SBP and CRP level in severe preeclampsia (Figure 3).

A positive correlation was observed between DBP and CRP level in severe preeclampsia (Figure 4).

Table 1: Demographic and clinical characteristics of study participants.

Characteristics	Mild preeclampsia, (n=15)	Severe preeclampsia, (n=15)
Age (in years)	26.5±3.5	28.0±4.5
Gestational age (in weeks)	32.4±2.3	34.6±2.1
BMI (kg/m^2)	27.5±3.2	28.9±3.7
CRP level (mg/L)	13.03±1.28	16.23±1.06
SBP (mm of Hg)	150±5.4	164±5.4
DBP (mm of Hg)	98±6.2	115±8.6

Table 2: Mean serum CRP level between cases and controls.

CRP level (mg/L)	Cases	Controls
Sample size	30	30
Mean±SD	14.63±1.99	5.98±1.86

Table 3: Mean serum CRP level in mild and severe preeclampsia patients.

CRP level (mg/L)	Mild preeclampsia	Severe preeclampsia
Sample size	15	15
Mean±SD	13.03±1.28	16.23±1.06

Table 4: Correlation of SBP and DBP with CRP level in mild preeclampsia patients.

Parameters	CRP level (mg/L)
	R value
SBP	0.97
DBP	0.98

Table 5: Correlation of SBP and DBP with CRP level in severe preeclampsia patients.

Parameters	CRP level (mg/L)
	R value
SBP	0.95
DBP	0.93

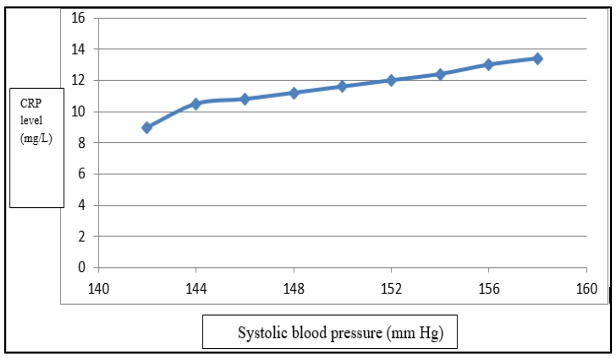

Figure 1: Correlation of SBP with CRP level in mild preeclampsia.

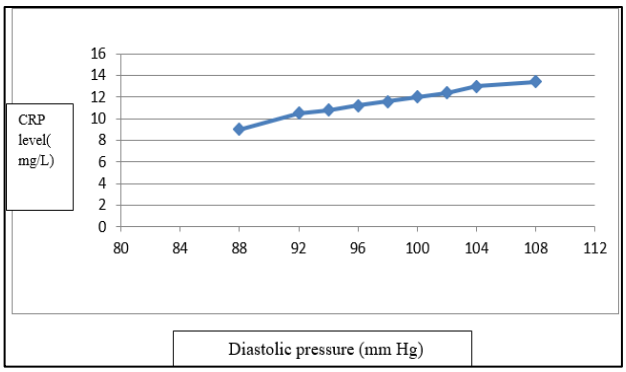

Figure 2: Correlation of DBP with CRP level in mild preeclampsia.

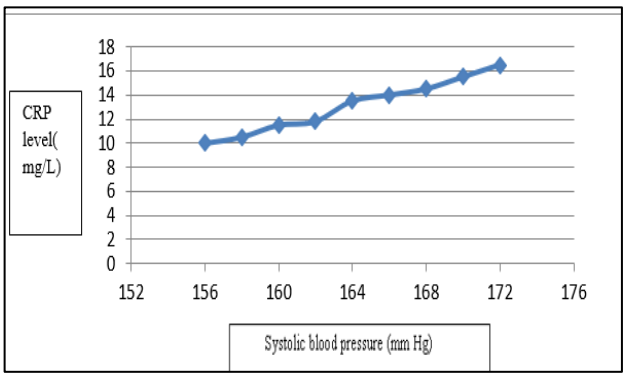

Figure 3: Correlation of SBP with CRP level in severe preeclampsia.

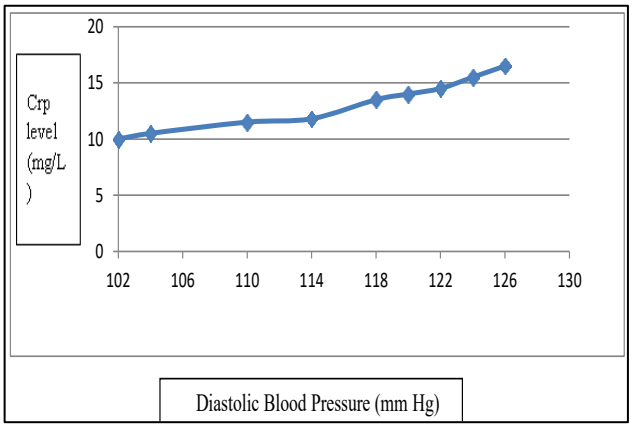

Figure 4: Correlation of DBP with CRP level in severe preeclampsia.

DISCUSSION

The present study was done to find the serum CRP level in normal and preeclamptic women and also to find the correlation between serum CRP level and severity of preeclampsia.

In the present study, serum CRP level was found to be higher among cases (14.63±1.99 mg/l) than in controls (5.98±1.86 mg/l). ($p<0.001$). Serum CRP level was also

significantly higher among the severe preeclamptic women (16.23±1.06 mg/l) than in mild preeclamptic patients (13.03±1.28 mg/l) ($p<0.001$).

Ismael et al also found that CRP levels were significantly higher in preeclampsia patients compared to controls and also significantly higher in the severe group than in the less severe mild group.[7] Todorovska et al found that serum CRP level was significantly elevated among the severe preeclamptic women compared to the mild ones, and CRP levels correlated with SBP.[8] Ustun et al measured serum CRP and fibrinogen levels in normal pregnancies and mild and severe preeclampsia groups. Both CRP and fibrinogen were significantly elevated in mild and severe preeclampsia groups.[9] The study by Shetty et al reported an association of maternal CRP with the severity of preeclampsia.[10] The study by Bansal et al compared mild and severe preeclamptic patients with controls. They found significantly higher hs-CRP levels in mild and severe preeclampsia patients compared to controls.[11] Sayyed et al compared normal pregnancies, mild and severe, measuring hs-CRP. The mean hs-CRP was significantly higher in women with severe preeclampsia than in women with mild preeclampsia. Also, hs-CRP correlated positively with blood pressure in preeclamptic women.[12] Gharib et al conducted a case-control study consisting of 15 mild, 15 severe, and 15 healthy women. CRP levels correlated positively with SBP, DBP, proteinuria, AST, ALT, and uric acid. They concluded that CRP is elevated in preeclampsia and correlated with disease severity.[13] The conclusions drawn by studies of Kusuma et al and Biswas et al were similar to the conclusions of our study.[14,15]

Limitations

There are a number of limitations to the study that should be taken into account. CRP is a non-specific inflammatory marker that can be increased by other underlying disorders like infections. If these illnesses are not sufficiently accounted for, the results may get confounded. The results may also be less applicable to larger populations due to the single-center design and very limited sample size. Additionally, depending only on one CRP measurement would not adequately capture the dynamic inflammatory changes that occur during pregnancy. The practical application of the study's findings is further limited by variations in the clinical classification of preeclampsia severity and the absence of longitudinal follow-up data to evaluate maternal or fetal outcomes.

CONCLUSION

The condition known as preeclampsia is linked to widespread endothelial cell dysfunction, most likely brought on by a systemic inflammatory maternal response. A positive indicator of inflammation, CRP is higher in overt preeclampsia than in a typical pregnancy. CRP levels and illness severity showed a favorable correlation in our investigation.

Thus, we deduce that preeclampsia causes a higher CRP level than a typical pregnancy and that severe preeclampsia causes a higher CRP level than mild preeclampsia. Serum CRP level can therefore be used as a useful metric for evaluating preeclampsia; however, additional cohort research on a bigger sample is required to validate our results before a definitive conclusion can be made.

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Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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