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Evaluating Serum Amyloid A as a Biomarker in Preeclampsia

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Abstract

***Background*:** Preeclampsia (PE) is the major cause of perinatal morbidity and mortality. The causes of the condition can be ascribed to excessive maternal systemic inflammatory response to pregnancy. Emerging evidence indicates that serum amyloid A (SAA), the acute phase response protein, may be a damage-associated molecular pattern molecule in pregnancy. This study aimed to evaluate serum amyloid A as a biomarker in preeclampsia.

***Methods and Results*:** This case-control study was conducted at Babylon Teaching Hospital for Maternity and Children from January 23, 2024, to June 13, 2024. The study involved 65 patients diagnosed with PE during their third trimester and 65 healthy expectant mothers (the control group). Preeclampsia was diagnosed according to the criteria of the American College of Obstetricians and Gynecologists (ACOG, 2020).

Patients provided midstream urine samples for protein level estimation using dipstick tests. After a rest, blood pressure was measured three times, and the final recorded reading was the average of the two lowest readings from those three measurements. The sandwich-ELISA method was used to estimate Human SAA levels. The median SAP in the PE group was 38.48 μg/mL versus 30.74 μg/mL in the control group (P<0.001). We found significantly higher SAA levels in PE patients with stage 2 hypertension than in PE patients with elevated blood pressure or stage 1 hypertension (P=0.036).

***Conclusion*: S**erum amyloid A is a promising biomarker for predicting the progression of preeclampsia. Further study of SAA during pregnancy may explain how inflammation is initiated in gestational tissues in normal and abnormal pregnancies. (**International Journal of Biomedicine. 2024;15(1):108-111.**)

Keywords: serum amyloid A • preeclampsia • hypertension

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Introduction

Preeclampsia (PE) is a significant pregnancy complication affecting approximately 5-10% of pregnancies worldwide, particularly in developing countries where healthcare resources may be limited.[1] Characterized by new-onset hypertension and proteinuria after 20 weeks of gestation, PE poses serious risks to both maternal and fetal health, including potential progression to eclampsia and long-term cardiovascular issues for the mother.[2] Despite advances in understanding its pathophysiology, effective treatments remain elusive, making early identification of at-risk women a critical goal in obstetrics.[3]

Despite significant progress in understanding the pathogenesis of preeclampsia, the only available treatments are delivery and placenta removal. Placental pathology is assumed to be the ultimate result of aberrant spiral artery remodeling and can reveal information about the disease's underlying causes and pathophysiologic mechanisms.[4,5]

Placental hypoxia and/or ischemia, high levels of oxidative stress, and endothelial dysfunction are the hallmarks of preeclampsia. The most noticeable aspect of this condition is endothelial dysfunction, caused by releasing soluble substances from the ischemic placenta into maternal plasma.[6] Serum amyloid A (SAA) is an acute response protein primarily generated by the liver during infection.[7] However, it is unknown if SAA may be produced in human fetal membranes, where it can trigger events related to labor initiation. Cytokines like IL-6 and TNF-α stimulate SAA liver production. However, SAA can influence the onset and progression of endothelial dysfunction through inflammation.[8]

This study aimed to evaluate serum amyloid A as a biomarker in preeclampsia.

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Materials and Methods

This case-control study was conducted at Babylon Teaching Hospital for Maternity and Children from January 23, 2024, to June 13, 2024. The study involved 65 patients diagnosed with PE during their third trimester and 65 healthy expectant mothers.

Preeclampsia was diagnosed according to the criteria of the American College of Obstetricians and Gynecologists (ACOG, 2020).

Patients provided midstream urine samples for protein level estimation using dipstick tests. After a rest, blood pressure was measured three times, and the final recorded reading was the average of the two lowest readings from those three measurements. The sandwich-ELISA method was used to estimate Human SAA levels.

Statistical analysis was performed using the statistical software package SPSS version 26.0 (SPSS Inc, Armonk, NY: IBM Corp). Baseline characteristics were summarized as frequencies and percentages for categorical variables and mean±standard deviation (SD) for continuous variables. For data with normal distribution, inter-group comparisons were performed using Student's t-test. Group comparisons with respect to categorical variables are performed using the chi-square test. The Mood's Median Test was used to determine whether the medians of two independent samples were equal (the null hypothesis). A probability value of $P<0.05$ was considered statistically significant.

Ethical Considerations

The study protocol was reviewed and approved by the Ethics Committee of the University of Babylon, Iraq. Written informed consent was obtained from all the participants.

Results

The parameters of the BMI, age, and gestational age of the participants in the PE group and control group showed no significant differences ($P>0.05$) (Table 1).

Table 1.

Main demographic characteristics of study subjects.

Characteristics	PE group (n=65)	Control group (n=65)	*P*-value
Age (years)	28.28±6.52	28.22±4.97	0.953
BMI (kg/m^2)	31.93±4.46	31.26±4.33	0.387
Gestational age (week)	34.18 ±2.97	33.63±2.48	0.254

The study found that SBP and DBP were significantly higher in the PE group than in the control group ($P<0.001$ in both cases) (Table 2).

A trace of protein in urine was found in 20% of PE patients. Urinary dipstick values of 1+, 2+, and 3+ for protein were found in 26%, 36%, and 16% of cases, respectively, in the PE group, compared to 1%, 0%, and 0%, respectively, in the control group. The differences were statistically significant ($P<0.0001$) (Table 3).

Table 2.

Systolic and diastolic blood pressure of study subjects.

Systolic blood pressure	Study group	
	PE group	Control group
Mean	143.82	120.31
SD	19.87	2.48
Minimum	100	120
Maximum	200	140
P-value	<0.0001	
Diastolic blood pressure	Study groups	
	PE group	Control group
Mean	92.08	83.54
SD	12.1	5.03
Minimum	70	80
Maximum	116	100
P-value	<0.0001	

Table 3.

Urine dipstick test .

Urinary dipstick protein	PE group (n=65)	Control group (n=65)
Negative	0	64
%	0.00%	98.50%
Protein trace	13	0
%	20.00%	0.00%
1+	17	1
%	26.15%	1.54%
2+	24	0
%	36.92%	0.00%
3+	11	0
%	16.92%	0.00%
P-value	<0.0001	

The study results showed a statistically significant difference in the SAA level between PE patients and the control group. The median SAA in the PE group was 38.48 μg/mL versus 30.74 μg/mL in the control group ($P<0.001$) (Table 4).

We found significantly higher SAA levels in PE patients with stage 2 hypertension than in PE patients with elevated blood pressure or stage 1 hypertension ($P=0.036$) (Table 5).

Table 4.

SAA level in the study groups.

SAA (µg/mL)	Study group	
	PE group	Control group
Median	38.48	30.74
5% CI	35.22	30.56
95% CI	40.01	31.7
Minimum	20	21.7
Maximum	43.65	40.74
P-value	<0.001	

Table 5.

The association between elevated SAA and hypertension severity.

		Elevated blood pressure or stage 1 hypertension	Stage 2 hypertension	*P*-value
SAA (µg/mL)	Median	34.89	39.6	0.036
	5% CI	33.89	35.47	
	95% CI	40.1	40.13	

Discussion

Preeclampsia is characterized by hypertension and proteinuria that begins in the second half of pregnancy. Endothelial dysfunction and trophoblastic hypoperfusion seen in preeclampsia are suggested to be part of an excessive maternal inflammatory response to pregnancy.[9]

Preeclampsia is characterized by excessive and progressive immune system activation, along with an increase in proinflammatory cytokines and antiangiogenic factors in the fetoplacental unit and vascular endothelium in pregnant women.[10]

The results suggest that elevated levels of SAA are associated with preeclampsia and may reflect underlying inflammatory processes contributing to endothelial dysfunction. This aligns with previous research indicating that SAA can influence the onset and progression of preeclampsia through inflammatory pathways. The findings highlight the potential role of SAA as a biomarker for early identification of at-risk women.[11,12]

In our study, a statistically significant difference in SAA levels between the PE and control groups is indicated by the *P*-value of 0.036. In addition, our results suggest that more severe hypertension might be linked to elevated levels of SAA protein.

Serum amyloid A (SAA) protein levels in PE patients with severe hypertension suggest a possible connection between inflammation and the advancement of hypertensive status. These findings create opportunities for more investigation and provide new insights and potential therapeutic strategies for hypertension.[13-16]

Conclusion

Serum amyloid A protein is a promising biomarker for predicting the progression of preeclampsia. Future studies should focus on validating these findings across larger populations and exploring the role of SAA in the pathogenesis of preeclampsia.

Competing Interests

The authors declare that they have no competing interests.

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