Original Article

Association of Serum Ferritin Level with Pre-eclampsia

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Abstract

Background: *Pre-eclampsia is a hypertensive multisystem disorder of pregnancy related to well-documented risks for the mother and the fetus. Pre-eclampsia and eclampsia are the third leading causes of maternal mortality in developing countries. Pre-eclampsia is one of the most common causes of maternal, fetal morbidity and mortality in Bangladesh. The exact etiology is unknown, but it may be associated with the elevated level of serum ferritin in patients with pre-eclampsia and eclampsia compared to pregnant women with normal progression.*

Objective: *The aim of this study was to find out the association between the level of serum ferritin and the development of pre-eclampsia in pregnancy.*

Methods: *This analytical cross-sectional study was carried out in the Clinical Pathology and Physiology department of International Medical College Hospital (IMCH). A total of 100 pregnant women in the third trimester of pregnancy reported to the Obstetrics and Gynaecology department of IMCH, Digital Hospital of Gazipur and Maa O Shishu Hospital of Narsingdi, were selected as study subjects. The study period was from January 2021 to December 2021. Among them, 50 pregnant women in their third trimester of pregnancy with pre-eclampsia were selected as group I and 50 pregnant women with normal progression as group II. Serum ferritin levels of all were assessed.*

Results: *The mean (±SD) serum ferritin level in the preeclampsia group (group I) was 175.03±55.52 ng/ml and that in the normal pregnancy group (group II) was 40.25±20.00 ng/ml. The difference between two groups is statistically significant ($p<0.001$). Proportion of women with body mass index (BMI) >25 Kg/m^2 was significantly more in group I compared to group II (90% and 61%, respectively, $p<0.05$). Antenatal checkup was more irregular in group I compared to group II (40%, 20%, respectively, $p<0.05$).*

Conclusion: *This study revealed that elevated serum ferritin level may be a good indication for early diagnosis of preeclampsia and early preventive measures can reduce maternal, fetal morbidity and mortality.*

Key words: *Serum ferritin, Pre-eclampsia, Indicator, Pregnancy*

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Introduction

Pre-eclampsia is a multisystem illness specific to human pregnancy characterized by the onset of new hypertension after 20 weeks of pregnancy and the involvement of one or more other end-organ systems as well as the fetus[1]. According to a recent publication, the maternal mortality ratio in Bangladesh was 196

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(uncertainty range = 159-234) per 100000 live births. Haemorrhage contributed to 31% and eclampsia to 23% of the maternal deaths[2].

Serum ferritin is a ubiquitous intracellular protein that stores iron and it releases in controlled fashion. Ferritin is major iron storage protein found in spleen, liver, bone marrow and also mucosal cells of small intestine, the placenta, kidney, testes, skeletal muscle and plasma[3]. Ferritin is an important intracellular storage protein that holds iron in a soluble and nontoxic state and it is observed that serum ferritin level elevates in women with preeclampsia[4]. In pregnancy, serum ferritin concentration is maximum at 12-16 weeks, then falls with advancing gestation[4,5]. High serum ferritin concentration in the third trimester, resulting from a failure of ferritin to decline, is associated with various complicated outcomes of pregnacy[6]. It is therefore important to identify women who are at high risk of developing the disease early in pregnancy. This not only helps the early identification of serum ferritin level as a biochemical marker of pre-eclampsia but also helps in determining those patients who are more likely to get benefit from prenatal measures to reduce the maternal as well as foetal risk[7]. Elevated serum ferritin and related changes in blood are identified as contributory to the etiology basis in pre-eclampsia and its relationship with the severity of the disease[8,9].

This study was designed and conducted to find out the association between level of serum ferritin and the development of pre-eclampsia in pregnancy.

Materials and Methods

An analytical cross-sectional study was conducted in the Clinical Pathology and Physiology department of International Medical College Hospital (IMCH), Gazipur, from January 2021 to December 2021. A total of 100 pregnant women in the third trimester of pregnancy who attended the Obstetrics and Gynaecology department of IMCH, Digital Hospital in Gazipur and Maa O Shishu Hospital, Narsingdi, were selected as study subjects.

Among the subjects reported, 50 patients were diagnosed as a case of pre-eclampsia and were selected as sample of group I and 50 pregnant women included with normal progression were selected as control in group II. The patients were aged between 20 to 36 years. Pregnant women with pre-existing hypertension, diabetes mellitus and renal disease were excluded from the study with the help of history, clinical examination and relevant laboratory investigation. After obtaining informed written consent from all the study subjects, data were documented in a predefined data sheet. Maintaining all the specific precautions, blood samples were collected from the study subjects for estimation of serum ferritin levels. Serum ferritin level measured in the Immunoassay method by BEKMANN COULTER ACCESS-2. Statistical analysis was performed by using computer-based software SPSS for windows version 20. Statistical analyses were performed as applicable and p-value <0.05 was considered as a level of significant.

Result

The study included variables such as anti-natal check-up (ANC) and Body mass index (BMI) are shown in the table I & II. There were 50 pregnant women with pre-eclampsia (moderate to severe pre-eclampsia) and 50 pregnant women with normal progression. In this study, it was observed that the frequency of anti-natal cheek up among group I was significantly (p= 0.03) less compared to that of group II. Most of the patients in this study were overweight (BMI >25 kg/m^2) and it was also observed that BMI of group I was significantly higher (p<0.05) compared to that of group II (Table II). Serum ferritin level was markedly higher in group I (Table IV) and is statistically highly significant (p<0.001).

Table I

Distribution of study subjects by nature of antenatal check-up

Antenatal check-up	Group I (n=50) Frequency (%)	Group II (n=50) Frequency (%)	P value
Regular	30 (60)	40 (80)	0.031*
Irregular	20 (40)	10 (20)	

Note: Chi-square test done and * difference is statistically significant

Table II

Distribution of the study subjects by BMI (Body Mass Index)

BMI (Kg/m^2)	Group I (n=50)		Group II (n=50)		P value
	Frequency	%	Frequency	%	0.042*
Normal weight (18.5- 24.9)	05	10	19	38	
Overweight or Obese (>25)*	45	90	31	62	

* As per the WHO Asia Pacific Criteria[9]; p-value from unpaired student t-test and is significant

Table III

Comparison of serum ferritin levels between two groups.

Serum ferritin (ng/ml)	Group I (n = 50)	Group II (n = 50)	P value
Mean ± SD	175.03±55.52	40.25±20.36	<0.001*

Note: * p-value from Mann-Whitney Test and is significant

Discussion

Preeclampsia is a hypertensive complication of pregnancy. It is a significant cause of maternal and perinatal mortality and morbidity. Preeclampsia, associated with proteinuria and oedema occurs primarily in nulliparous women after 20 weeks of gestation, most frequently near the term[10].

In the present study, the regularity of antenatal check-up was observed to be significantly less frequent in pregnancies with pre-eclampsia group compared to pregnancies with normal progression group. Fadilah and Devy in their study observed that there was influence of antenatal care visit on early detection of pre-eclampsia and the intensity of antenatal visits were influenced by the level of knowledge of the mother[11]. In this study, considering BMI, 90% of pregnant women in preeclampsia group were overweight and the rate was significantly ($p<0.05$) higher than the pregnant women with normal progression. In a review, it was observed that preeclampsia (PE) affects 2-4% of pregnancies worldwide and women with obesity face an elevated risk of developing PE[12].

In this study, the mean serum ferritin level was observed to be 175.03±55.52 ng/ml in preeclampsia group and 40.25±20.36 ng/ml in the pregnancy with normal progression group. The difference in findings of between two groups was statistically significant ($p<0.001$). In a study in Bangladesh the mean serum ferritin level of PE group was almost 10 times higher (167.11±10.43 ng/ml) than that of controls (17.0±3.03 ng/ml)[1]. The mean serum ferritin level observed in PE group was closer to the value of the present study, but the mean value of control group was markedly lower in the referred study. Another recent study in Bangladesh showed that the mean serum ferritin in preeclamptic women was 124.54±32.14 ng/ml and 50.83±2.53 ng/ml in the control group, where the difference between values was less but statistically significant ($p<0.001$)[13]. The study observed that serum ferritin was positively correlated with raised blood pressure. A few other studies showed that there was significant difference in serum ferritin among normal pregnant and both mild and severe preeclampsia and they concluded that measurement of this elements may be used for the early diagnosis of preeclampsia condition[14-17]. Risk of pregnancy-related hypertensive disorders increases with increasing early pregnancy serum ferritin level. Detection of serum ferritin levels may therefore be used to further develop guidelines for iron supplementation therapy in pregnant women[18]. So early detection of serum ferritin level may reduce the incidence of pre-eclampsia and increase the maternal and perinatal outcomes.

Conclusion

The finding of this study elevated serum ferritin level was associated with pre-eclampsia as part of antenatal check-up may help to establish

diagnosis of pre-eclampsia before appearance of clinical manifestations. So, early diagnosis and prevention of preeclampsia routine investigation of serum ferritin should be advocated. The role of early detection of serum ferritin may help in the reduction of systemic complications and maternal death due to preeclampsia.

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