ejpmr, 2020,7(12), 95-99

SJIF Impact Factor 6.222

EUROPEAN JOURNAL OF PHARMACEUTICAL AND MEDICAL RESEARCH

www.ejpmr.com

Research Article

ISSN 2394-3211

EJPMR

COMPARATIVE STUDY ON SERUM IRON AND IRON BINDING CAPACITY IN PREECLAMPTIC AND NORMOTENSIVE PREGNANCY

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Article Received on 07/10/2020 **Article Revised on 27/10/2020** **Article Accepted on 17/11/2020**

ABSTRACT

It was a cross sectional comparative study on serum iron and iron binding capacity in preeclamptic and normotensive pregnancy conducted in the Outpatients and inpatients department of Obstetrics & Gynaecology, Institute of Child and Mother Health from January 2011 to December 2012. A total number of 92 pregnant women were selected. Among them, 46 pregnant women with preeclampsia are in study group and 46 normotensive pregnant women are in control group.

The age of the patients in study group was 24.1±4.4 (mean±SD) years and that of control group was 22.8±2.1 years. Among the patients with study group 26 (56.5%) were primi and 20 (43.5%) were multi para. Among the control group 36 (78.3%) were primi and 10 (21.7%) were multi para. Mean±SD of gestational age of study group and control group were 36.6±1.3 weeks and 37.9±0.7 respectively.

The Mean ±SD of serum iron level among the patients with study and control groups were 8.21±2.14 and 5.00±1.96 p mol/L respectively. Mean ±SD of total iron binding capacity among the study and control group 15.02±5.89 and 24.63±6.43 percent respectively.

KEYWORDS: Serum iron, serum iron binding capacity, pregnant women, preeclamptic pregnant women, normotensive pregnant women

INTRODUCTION

Pregnancy is a physiological condition and usually has no effect on general health of a pregnant woman. However pregnancy results in hormonal, haemodynamic and haematological changes. These physiological changes need to be viewed as normal adaptations determined by nature.[1] The cultural or environmental factors, age at initiation of childbearing and length of inter pregnancy intervals; have not been sufficiently investigated.[2] Nutritional iron deficiency is highest in the population of peak growth rates, such as infants, young children, and pregnant women.[3] The risk of developing iron deficiency is greatest during pregnancy.[4]Iron requirements are greater in pregnancy than in non-pregnant state.[1]

In normal pregnancy, maternal serum ferritin level decreases with advancing gestation, even when iron supplementation has been given antenatally. However, the need for high-dose iron supplementation in mothers with low serum ferritin has not been established, since the human fetus can accumulate iron normally, even in the presence of maternal iron deficiency, and the cord serum ferritin level is not correlated with maternal level.[5,6] The previously report that there is elevation of serum iron in preeclampsia. When patients with preeclampsia and pregnant women with chronic hypertension were compared; a serum iron value greater than normal pregnancy, is a sensitive and specific indicator of preeclampsia.[7] Serum iron concentration was increased in women with preeclampsia (mean 135 mcg/dl) compared to normotensive parturient (62 mcg/dl) and chronic hypertensive parturient (72 mcg/dl). Mean iron for eclamptics was 203 mcg/dl; for severe preeclamptic, 137 mcg/dl independent of hepatic or renal function. Recovery to normal postpartum levels occurred in 1-3 days.[7]

Preeclampsia is defined as a pregnancy-specific syndrome observed after the 20th week of pregnancy with systolic blood pressure of >140 mm Hg or diastolic blood pressure of >90 mm Hg accompanied by significant proteinuria (i.e. urinary excretion of >0.3 g protein in a 24-h specimen). In women with preeclampsia, blood pressure usually returns to baseline within days to weeks after delivery.[8]

The etiology and pathogenesis of preeclampsia remains poorly understood.[9] In preeclamptic women it is impossible to decipher cause from effect. Nonetheless, current concepts of the genesis of preeclampsia that include endothelial dysfunction, inflammatory activation, oxidative stress and predisposing maternal factors provide targets for well-designed nutritional investigation.[8] For many years diet has been suggested to play a role in preeclampsia. The hypothesis have been diverse and often mutually exclusive. Thus, increased and reduced dietary sodium, protein, fats or carbohydrates were proposed as possible etiological factors.

Preeclampsia is one of the commonest causes of prenatal and maternity related death in the world.[8,10,11] Preeclampsia affects 5 to 10 percent of all pregnancies.[11] It is assumed that preeclampsia and the associated obstructive lesion of the spiral arteries called acute atherosclerosis lead to placental ischemia.[12]

However a causal sequence of events in pregnant women cannot be proved. It is possible that pre-eclampsia causes placental ischemia although more likely that placental ischemia causes preeclampsia especially as poor placentation is an early preclinical development. Moreover, preeclampsia can be induced in pregnant animals by surgical restriction of the uteroplacental blood supply.

In the developing countries, women lost their lives due to preeclampsia every year and the risk of infant mortality in preeclampsia is 4 times higher than that in normal pregnancies.[10] In a baseline survey for assessment of EOC services in Bangladesh, 5% of the total obstetrics admissions in health facilities were due to preeclampsia and eclampsia.[13] According to Survey on maternal mortality in Bangladesh, in 2010 eclampsia contributes 20% of the maternal mortality on a national basis which is equivalent to about 4500 women in one year.

Entman et al. (1987)[14] reported increased free iron in preeclampsia. Increased free iron may represent hemolysis, known to be a feature of preeclampsia. Anemia is a marker for many forms of nutritional deficiency.[15] Increased ferritin is not only a marker of reduced iron stores but also an inflammatory marker as is also the case with reduced transferrin.[16,17]

Hypothesis

Increase serum iron is associated with pre-eclampsia.

General Objectives

- To compare the level of serum iron in preeclamptic and normotensive women in third trimester of pregnancy

Specific Objectives

- To measure the serum iron and TIBC among the preeclamptic patients and normotensive group
- To compare the serum iron and TIBC among the preeclamptic patients and normotensive group

MATERIALS AND METHODS

Study design

It was a cross sectional comparative study.

Place of study

Outpatients and inpatients department of Obstetrics &Gynaecology, Institute of Child and Mother Health; Matuail, Dhaka

Period of study: From January 2011 to December 2012.

Study Population

The entire preeclampsia patient admitted during study period.

Sample Size: 92 Sample size

Determination of sample size

The sample size has been determined to measure a given proportion with a given degree of accuracy at a given level of statistical significance by using the following formula.

To determine the sample size,
Formula is used; $n = z^2pq/c?$

Where,

n= the desired sample size which would help to measure the different indicators

z= the standard normal deviate, usually set at 1.96 at 5% level which corresponds to 95% confidence level;

p= the assumed target proportion is p to have a particular characteristics and q=l- p. Here p = 0.0439 (4.39%) prevalence rate of preeclampsia is DMCH 4.39% (Annual statistics_2009).

d= Degree of accuracy, which assume is 0.05

Putting the values in the above equation the sample size n is estimated as $(3.84X\ 0.0439X\ 0.9561)/\ 0.05^2 = 64.49$ n= 65 (Estimated sample size)

However, for time constraints 46 women in each group and total 92 women were included in this study.

Sampling method: Purposive sampling

Selection criteria
Inclusion criteria
For study group:

- Age 20-35 yrs
- 28-40 weeks of Singleton pregnancy
- Blood pressure > 140/90 mm Hg (Taken on two occasions 6 hours apart)
- Urinary protein of 0.3 gm/L or more

For control group

- Age 20-35 yrs
- 28-40 weeks of Singleton pregnancy
- Normal blood pressure
- Urinary protein nil/ trace

Exclusion criteria
Any associated medical disorders like anaemia diabetes mellitus, renal disease, chronic hypertension, liver disease and those who were on medications (such as diuretics, corticosteroids which could alter serum iron profile).

Ethical consideration
Ethical clearance and permission for the study was taken from appropriate authority. All study group and control group were given an explanation of the study and informed written consent was taken. The study was not involved any significant risk as well as economic burden to the patients.

Data Collection Methods
A total number of 92 pregnant women were selected. Among them, 46 pregnant women with preeclampsia were in the case group and 46 normotensive pregnant women were in the control group. Data were collected in a predesigned data collection sheet. Those were collected by interview, observation, clinical examination, biochemical investigations, from history sheet of the patient. After selection of the study subjects, the objectives, nature, purpose and potential risk of all procedures used for the study was explained in details and informed written consent from the patients was taken. Proteinuria was measured by using dipstick method. With all aseptic precaution, about 5 ml of venous blood was collected from medial cubital vein from each subject and blood was sent to laboratory for biochemical test. Serum iron and total iron-binding capacity were assayed spectrophotometrically (Hitachi 7600; Hitachi, Tokyo, Japan).

Data Analysis
Data were analyzed using SPSS version 16 (SPPS Incorporation, Chicago, EL, USA). Continuous variables were presented as mean ± SD, and categorical variables were as frequency and percentage.

RESULTS AND OBSERVATION

Table 1: Distribution of characteristics of the patients by groups.

Variables	Group		P-value
	Study (n=46)	Control (n=46)	
Age			
Mean ±SD (20-35yrs)	24.13±4.4	22.8±2.1	0.078
Parity			
Primi	26 (56.5%)	36 (78.3%)	0.22
Multi	20 (43.5%)	10 (21.7%)	
Gestational age			
Mean ±SD(range)	36.6±1.3 (32-40)	37.9±0.7	0.000
28-34	02(04.3%)	0 (0.0%)	0.000
35-37	29(63.0%)	05(10.9%)	
>38	15(32.6%)	41(89.1%)	

* Student t test #Chi square test

Table 1 shows the distribution of characteristics of the patients by groups. Mean ±SD of age of study group and control group were 24.13±4.4 and 22.8±2.1 respectively. There is no statistically significant difference in age between the groups ($p>0.05$). Among the study group 26 (56.5%) were primi and 20 (43.5%) were multi para. There is no statistically significant difference in para between the groups ($p>0.05$). Mean ±SD of gestational age of study group and control group were 36.6±1.3 weeks and 37.9±0.7 respectively. There is statistically significant difference in gestational age between the groups ($p<0.05$). Among the respondents in study group gestational age of 02(04.3%) were 28-34 weeks, 29(63.0%) were 35 to 37 weeks and 15(32.6%) were >38 weeks.

Table 2: Distribution of laboratory parameters by groups.

Laboratory parameter	Group		P value
	Study(n=46)	Control(n=46)	
Serum iron level (p mol/L)	8.21±2.14	5.00±1.96	0.001
Total iron binding capacity (%)	15.02±5.89	24.63±6.43	0.008

Table 2 shows mean serum iron level among the study group was significantly higher than normal (control) patients. Total iron binding capacity among was lower among the study group than normal; however, the difference was statistically significant ($p<0.05$).

DISCUSSION

In the present study the mean ± SD of serum iron level among the patients with study and control groups were 8.21 ± 2.14 and 5.00 ± 1.96 p mol/L respectively. Mean ±SD of total iron binding capacity among the study and control group 15.02 ± 5.89 and 24.63 ± 6.43 percent respectively. There is statistically significant difference in serum iron and total iron binding capacity and between the groups.

Vitoratos et al.[18] in their study reported that the mean ±SD serum iron level was greater whereas the total iron binding capacity was lower in women with preeclampsia when compared to normal pregnancies (P 0.0l and P<0.0001 respectively). Al-Jawadi and Bashi,[19] reported that significant differences between serum iron and TIBC in between pregnant women with iron deficiency anaemia and pregnant controls (P< 0.001). They concluded that a reduction in the level of serum iron of pregnant women with iron deficiency anaemia at all trimesters, especially the third trimester, (P< 0.001). Lao et al.[20] in their study reported that the maternal ferritin concentration is primarily a reflection of maternal iron status, and a high level is associated with unfavorable outcome and the rationale of routine iron supplementation in non-anaemic women needs to be re-examined. Eslami et al.[11] reported that the iron and TIBC level had no significant difference in preeclampsia and normal pregnant woman. Entman et. al.[21]

found that serum iron concentration was increased in women with eclampsia compared to normotensive patient and chronic hypertensive patient. Basher and Deb,[22] studied to compare serum iron status in preeclamptic to normal pregnancy, which may help in the establishment of diagnosis of preeclampsia before appearance of its clinical manifestation. In their study the mean value of serum iron was significantly increased in the preeclamptic women in comparison to controls whereas mean values of both total iron binding capacity (TIBC) was significantly decreased in preeclamptic women in contrast to controls. Raman et al.[23] In their study reported that the mean ferritin levels were significantly elevated both in PIH and eclampsia as compared to controls indicating that ferritin measurement in PIH and eclampsia would not reflect iron nutritional status.

Raza et al.[1] in their study reported that the mean values of serum ferritin (SF), increased iron (Fe) and total iron binding capacity (TIBC) were significantly lower in the cases than in the control and significantly higher values of TIBC and UIBC were observed in the cases compared to controls. Significant correlations were observed for TIBC against serum iron in different trimesters of pregnancy. Rayman et al.[12] investigated iron status parameters in preeclampsia with a view to exploring their possible contribution to the etiology and concluded that released iron species in preeclampsia may contribute to the etiology and will exacerbate lipid peroxidation and endothelial cell injury. They concluded that it would seem inadvisable, in the absence of evidence of iron deficiency, to give iron supplements to pregnant women at high risk for preeclampsia. Raza et al.[1] in their study reported that a high percentage of the pregnant women are iron deficient due to factors such as high parity, poor dietary habits and socioeconomic status. Basher and Deb,[22] in a study recommended that routine investigation of serum iron status of pregnant women as part of antenatal checkup may help in the establishment of diagnosis of pre eclampsia before appearance of its clinical manifestation.

CONCLUSION

There was statistically significant increase in serum iron and decrease in total iron binding capacity in preeclamptic than normotensive women in third trimester of pregnancy. It can be suggested that if patient with high risk factors for development of pre-eclampsia can be tested for serum iron, may help in diagnosis of preeclampsia before appearance of clinical symptoms.

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