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Study of Antioxidant Status in Pregnancy Induced Hypertension

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Abstract

Aim of the study was to estimate the antioxidant status and cause of lipid peroxidation in the pregnancy induced hypertension. Pregnant women diagnosed with pre-eclampsia and eclampsia was admitted to Gynaecology and Obstetrics were recruited for the study, and age matched pregnant women attending the outpatient department without any complications were taken as controls. Blood samples were collected to study parameters lipid parameters and antioxidant levels. Pregnant women with age ranging from 19-30 years with pre-eclampsia and eclampsia were taken as cases and age matched healthy individuals Pregnant women with age of 20-30 was taken as controls for this study. Random blood samples were collected and analyzed for parameters like vitamin-E, vitamin-C, MDA, and ceruloplasmin. SPSS Software 17 and Excel sheets were used for statistical analysis. Systolic blood pressure (SBP), Diastolic blood pressure (DBP) and serum vitamin-C shown highly significant ($P<0.05$) rise in the patients with preeclampsia when compared to controls. Whereas Serum vitamin-E, ceruloplasmin and MDA has not shown any significant change. SBP and DBP have shown significant correlation with vitamin-E, cerruloplasmin and MDA. Supplementation of natural anti-oxidants like alpha tocopherol, ascorbic acid may be beneficial in preventing complications in pregnancy induced hypertension.

Keywords: Pregnancy induced hypertension, Malondialdehyde, Vitamin-C, Lipid parameters, Ceruloplasmin.

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Introduction

Pregnancy Induced Hypertension (PIH) is a serious complication of second half of pregnancy that occurs with a frequency of 5-15%. It is characterized by high blood pressure, urinary loss of proteins, edema and activation of haemostatic mechanisms. According to World Health Organization (WHO), PIH is the leading cause of fetal growth retardation, infant morbidity, mortality and maternal death [1].

Pregnancy is a stressful condition in which many physiological and metabolic functions are altered to a considerable extent. The generation of free radicals is a normal physiological process and free radical act on lipid to cause lipid peroxidation [2]. The cells have evolved a number of counteracting antioxidant defense mechanism. The etiology of PIH has always remained elusive. Increasing

evidence supports the role of lipid peroxidation in the pathophysiological mechanisms of pre-eclampsia [3]. Uncontrolled lipid peroxidation is known to play an important role in the pathophysiology of pre-eclampsia by causing vascular endothelial cell dysfunction. Excessive generation of free radicals, depressed antioxidant status or imbalance in peroxidation and free radical scavenging systems might play an important role in PIH [4].

Pre-eclampsia is associated with lipid peroxidation and is a key contributing factor to the pathophysiologic condition of preeclampsia. High levels of serum hydroperoxides and increased susceptibility of lipid peroxidation indicates preeclampsia to be associated with high oxidative stress [5]. Oxidative stress is a disturbance in the prooxidant antioxidant balance leading to potential damage. The ischemia/reperfusion injury associated with preeclampsia promotes both placental damage and release of factors leading to maternal endothelial dysfunction, and it has been postulated that alteration in the antioxidant activity may enhance endothelial cell oxidative damage [6, 7].

Vitamin-E is a most important chain breaking antioxidant and protects polyunsaturated fatty acid. The primary function of vitamin E is as an antioxidant in prevention of the nonenzymic oxidation of cell components, for example polyunsaturated fatty acids, by molecular oxygen and free radicals [8, 9].

Ceurloplasmin is an important regulator of membrane lipid - oxidation probably, by direct oxidation of cations - thus preventing their catalysis of lipid peroxidation [4].

Malondialdehyde (MDA) is a metabolic product of prostaglandins endoperoxides widely used as an indicator of per - oxidation of fatty acid. It has been observed in patients with pre-eclampsia, the serum concentration of lipid peroxides were elevated with a decrease in antioxidants.

The present study is undertaken to estimate the levels of antioxidant status and the markers of lipid peroxidation in relation to the raised blood pressure in PIH.

Materials and Methods

The study was carried with the patients attended to the Gynecology and Obstetrics OPD department. The study included a total of 40 patients, out of which 20 pregnant women diagnosed with pre-eclampsia and eclampsia with age range of 19-30 years were taken as cases, and 20 were healthy pregnant womens, individuals with age of range 20-30 years were taken as controls. Basic information like, age, weight, life style habits, hypertension etc, were taken from the individuals by questionnaire. Written consent forms were obtained from every individual.

Pre-eclampsia patients diagnosed with age of 18 to 30 years with gestation age more than 20 weeks were included in the study and the patients with history of diabetes mellitus, hypertension, renal diseases, liver disorder and patients with medication that interfere the parameters of the study were excluded. The blood samples were collected from the patients with 12 hours fasting and centrifuged after adequate clotting and then the serum was separated and kept at 4˚C until analysis was carried out. The serum was used to estimate the vitamin-E, vitamin-C, MDA, and ceruloplasmin.

The vitamin-E, vitamin-C, MDA, and ceruloplasmin were analyzed using manual method. Vitamin-E is estimated Baker and frank's (1968) method [10]. Vitamin-C is estimated using Omaye et al., (1974) method [11]. MDA was estimated using thiobarbituric acid method, where the pink colour chromogen formed was estimated at 530nm by method of Ohkawa, et al., 1979 [12]. Ceruloplamin is estimated using Method of Ravin, 1961 [13]. All the results were tabulated and statistics was done using SPSS Software 17.0 and Pearson correlation was used for the correlation of two

parameters. A p-value of <0.05 was considered to be statically significant.

Results

It is evident from the table-I that there is a highly significant (P<0.05) rise in the SBP, DBP and serum vitamin-C in the patients with preeclampsia when compared to controls. Whereas serum vitamin-E, ceruloplasmin and MDA has not shown any significant change in the patients with preeclampsia when compared to controls.

The pearson correlation study, SBP has shown significant correlation with vitamin-E (-0.548), ceruloplasmin (0.690), and MDA. Whereas DBP has shown significant correlation with vitamin-E (-0.407), ceruloplasmin (0.528) and MDA (0.636). The pregnancy induced hypertension (rise in SBP and DBP) causes rise in the oxidative stress (vitamin-C).

	Controls	Cases	P value
SBP	116.6±6.7	155.0±11.0	0.047**
DBP	77.5±7.2	104.0±12.7	0.004**
Vitamin E mg/dl	1.4±0.4	0.9±0.3	1.00
Vitamin C mg/dl	1.3±0.2	1.2±0.7	0.004**
Ceruloplasmin mg/dl	28.6±4.3	39.6±3.9	0.866
MDA nmol/dl	238.2±20.6	315.5±25.6	0.237
****. Significant at the 0.05 level.**			

Table 1: Group Statistics Mean ± SD and p value of different parameters of controls and cases

Correlations						
	SBP	**DBP**	**Vitamin E mg/dl**	**Vitamin C mg/dl**	**Ceruloplasmin mg/dl**	**MDA nmol/L**
SBP	1	0.751**	-0.548**	0.234	0.690**	0.745**
DBP	0.751**	1	-0.407**	0.126	0.528**	0.636**
Vit-E mg/dl	-0.548**	-0.407**	1	-0.406**	-0.385*	-0.404**
Vit-C mg/dl	0.234	0.126	-0.406**	1	0.260	0.072
Ceruloplasmin mg/dl	0.690**	0.528**	-0.385*	0.260	1	0.653**
MDA nmol/L	0.745**	0.636**	-0.404**	0.072	0.653**	1
****. Correlation is significant at the 0.01 level (2-tailed). *. Correlation is significant at the 0.05 level (2-tailed)**						

Table 2: Pearson correlation (r) values between different parameters

Discussion

Pregnancy induced hypertension (PIH) continues to be a major health care related problem in pregnant women despite advancements in the field of medical sciences. The spectrum of clinical presentation in PIH patients varies from mild (presenting only with small increase in blood pressure with/without presence of protein in the urine) to severe maternal and foetal complications [14].

The present study was conducted to assess the role of hypertension in pregnancy induced hypertension leading to oxidative stress by assessing the levels of antioxidants like vitamin-C, vitamin-E and ceruloplasmin and also

by assessing the lipid peroxidation products like MDA.

The major sign of PIH is hypertension, suggesting that it is due to vasospastic events in the placenta, kidney, uterus and brain. In our study, the mean systolic and diastolic blood pressure in PIH subjects were significantly higher ($p > 0.05$) than those of control subjects, this observation was in agreement with other studies [15-17]. There are numerous reports that oxidative stress is increased with hypertension, and there was so many methods to measure the *"in-vivo"* reactive oxygen species (ROS) which are the ultimate culprits to cause decrease in the defensive antioxidants such as vitamin-E, vitamin-C and the ROS also shows it effects on the free fatty acids to form lipid peroxidation products like MDA [18]. As like the same in our study we have noted significant decrease in vitamin-C where as vitamin-E and MDA levels has not shown any change in their levels. Ceruloplasmin being an antioxidant by its ferroxidase activity. Ferroxidative activity of ceruloplasmin converts toxic ferrous iron to less toxic ferric iron, which reduces the oxidative damage of lipids, proteins, and DNA. (Hellman and Gitlin, 2002) [19]. The ceruloplasmin being the acute phase protein its concentration in serum will be increased during inflammation (Guller et al., 2008) hypoxic conditions (Sarkar et al., 2003) and increased cerruloplasmin in hypertension is due to stressful alarm reactions (Fuchs et al., 1991) [20-22].

But the pearson correlation study has shown that increased SBP and DBP has shown significant correlation with the vitamin-E, MDA and ceruloplasmin which states that increased hypertension will alter both oxidants and antioxidant status and our findings is in accordance with the study of Nakazono et al., (1991) [23].

Conclusion

Hypertension in the PIH due to vasospastic events, cause oxidative stress which can leads to secondary complications. Hence we suggest, supplementation of natural anti-oxidants like alpha tocopherol, ascorbic acid may be beneficial in preventing complications in PIH.

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