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Research Article

A Comparative Study of Degree of Oxidative Stress in Pre-Eclamptic & Healthy Pregnant Women in Madhya Pradesh

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ABSTRACT

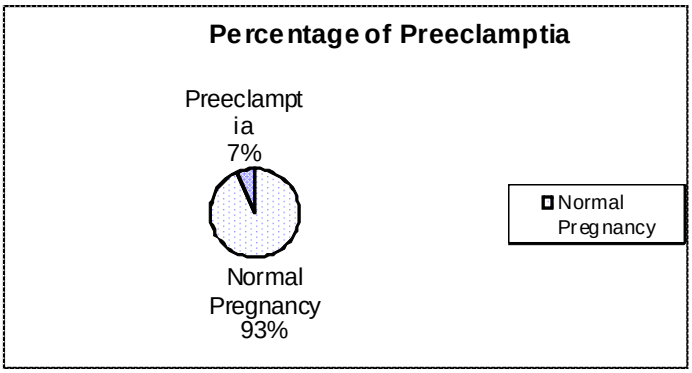
Pregnancy is a stressful condition in which many physiological and metabolic functions are altered to a considerable extent and hypertension is the most common medical problem encountered during pregnancy, complicating 5-10% of pregnancies. Recent reports suggest that free radical induced endothelial cell injury might be a factor in the pathogenesis of pre-eclamptia. Such cell injury might in turn cause uncontrolled lipid peroxidation, which in turn is counteracted by the action of several antioxidants. But because of increased lipid peroxidation and increased demand of antioxidants, increased oxidative stress is suspected. The aim of the present study is to compare lipid peroxidation and enzymatic antioxidant activities in pre-eclamptic women with healthy pregnant women in the late second trimester in MP, India. Normal pregnant women (Group-I) pre-eclamptic women (Group-II) with blood pressure >140/90 with albuminuria in the late second trimester were taken for the study. They were evaluated for MDA, SOD and Catalase levels. A significant rise in MDA level was observed in both study groups when compared with control. We found significantly high level of MDA in group I subjects comprising of normal pre-eclamptic women ($p<0.01$). When comparison was done between group I and group II subjects a significant difference ($p<0.05$) was observed i.e. level of MDA was significantly high in group II. In our study the antioxidant enzymes SOD and CAT activity was found to be decreased in normal pregnant and pre-eclamptic women comprising group I and II. Fall in SOD & CAT levels was more in pre-eclamptic women. A significant ($p<0.05$) difference in antioxidant enzymes was noted on comparing group I with group II. Thus Pregnancy is a physiological state accompanied by high-energy demand of many functions and increased oxygen requirement. Because of increased intake and utilization of oxygen, an increased level of oxidative stress is seen. Pregnancy induced hypertension or pre-eclampsia is a toxic condition that is accompanied by increased oxidative stress. Marker of oxidative stress MDA increases significantly and also a significant decrease in antioxidant enzyme due to their greater utilization is observed. Antioxidant supplementation can prove to be a good adjuvant therapy in controlling the oxidative stress.

Keywords: Pre-eclampsia, Oxidative stress, Malondialdehyde, Superoxide dismutase, Catalase.

INTRODUCTION

Pregnancy is a stressful condition in which many physiological and metabolic functions are altered to a considerable extent[1]. Hypertension is the most common medical problem encountered during pregnancy, complicating 5-10% of pregnancies. It is associated with oxidative stress, confirmed by measurement of biomarkers and relevant antioxidant enzymes in the placenta and maternal circulation. The incidence varies among different hospitals, regions and countries. In India the incidence of pre-eclampsia is reported to be 8-10% of the pregnancies[2,3]. Pregnancy induced hypertension is also known as Toxemia or Pre-eclamptia which occurs most often in the first pregnancy of young women. Pre-eclamptia is the main cause of maternal mortality and is associated with five-fold increase in perinatal mortality in developed countries. In spite of this the etiology of pre-eclamptia is unknown[4,5]. Pre-eclamptia is a toxic condition that is characterized by a sudden rise in blood pressure, excessive weight gain, generalized edema, albuminuria, severe headache and visual disturbance. With high blood pressure

there is increase in the resistance of blood vessel. Pre-eclampsia occurs during second and third trimester of pregnancy and it is more common in nulliparous women. It is characterized by 1) BP 140/90 mm Hg or greater at least on two occasions, six or more hours apart 2) Proteinuria_300 mg/24 hours or greater Oxidative stress increases during pre-eclampsia and results in increased production of lipid peroxides, reactive oxygen species and superoxide anion radicals to cause endothelial injury and dysfunction, platelet and neutrophil activation[6]. This may hinder blood flow in many different organ systems in the pregnant mother including liver, kidney, brain, uterus and placenta. This may lead to various other fetal complications[7]. Maternal morbidity with pre-eclamptia is one of the leading causes for the admission of young pregnant women to intensive care unit in the developed countries[8]. The delivery of women to prevent progression of pre-eclamptia is responsible for 15% of all pre term births. In developing countries, where inadequate prenatal care limits pre-eclamptia surveillance, maternal mortality is common accounting for 50,000 deaths yearly[9]. The etiology and pathogenesis of pre-eclamptia is poorly understood. Recent reports suggest that free radical induced endothelial cell injury might be a factor in the pathogenesis of pre-eclamptia. Such cell injury might in turn cause uncontrolled lipid peroxidation that in turn is counteracted by the action of several antioxidants[10,11]. Pregnancy is a physiological state accompanied by high-energy demand of many bodily functions and increased oxygen requirement. Because of increased intake and utilization of oxygen, increased levels of oxidative stress would be expected[12]. The free radicals scavenging molecules called antioxidants include enzymatic antioxidants like Superoxide dismutase (SOD), Catalase (Cat), Glutathione peroxidase (GSH-Px) and Glutathione reductase (GSH-Rx)[13, 14].



The aim of the present study is to compare lipid peroxidation and enzymatic antioxidant activities in pre-eclamptic women with healthy pregnant women in the late second trimester in MP, India.

MATERIAL AND METHODS

The present study was carried out in MGM Medical College and MY Hospital, Indore. 28 normal pregnant women (Group-I) and 35 pre-eclamptic women (Group-II) ranging in age 26±4 yrs with blood pressure >140/90 and with albuminuria in the late second trimester attending the obstetrics and gynecology department in MYH were selected for the study. The subjects with diabetes mellitus, obesity, severe anemia, alcoholics and tobacco chewers were excluded from the study. 22 age and sex matched normal, healthy non pregnant women were selected to serve as control group.

About 3-4 ml venous blood was collected and following parameters were estimated in study and control group.

1. Malondialdehyde level in erythrocytes (Utley et al 1967) (15).
2. Serum SOD level (Marklund & Marklund method 1974 modified by Nandi et al 1988) (16).
3. Serum Catalse level (L Goth 1991) (17).

Statistical analysis was done using MS excel. P value less than 0.05 were taken as level of significance.

Table 1: Oxidant & Antioxidant Status in Pre-eclamptic, Pregnant and Non-pregnant women

S. No.	Study Group	MDA in n mol/ml Mean ±SD	Serum SOD activity in U/ml Mean ±SD	Serum catalase activity in KU/L Mean ±SD
1	Control (n=22)	1.18 ±0.08	4.9±0.6	54.5±6.3
.	Group I- Normal Pregnant (n = 28)	2.45±1.44 #	3.3±0.3 #	47.2 ±5.3 #
3.	Group II- Pre-eclamptia (n = 35)	4.0±1.02# *	2.0± 0.3# *	42.3±0.6# *

# P<0.001 highly significant * p<0.05 significant
Significant difference when compared with control
* Significant difference when compared with group I

RESULTS

In the present study a significant rise in MDA level was observed in both study groups when compared with control. We found significantly high level of MDA in group I subjects comprising of normal pre-eclamptic women (p<0.01) rise was more in group II patients comprising pregnant pre-eclamptic women. When comparison was done between group I and group II subjects a significant difference (p<0.05) was observed i.e. level of MDA was significantly high in group II.

In our study the antioxidant enzymes SOD and CAT activity was found to be decreased in normal pregnant and pre-eclamptic women when compared with control group. Fall in SOD & CAT levels was more in pre-eclamptic women. A significant (p<0.05) fall in antioxidant enzymes was also noted on comparing group I with group II. Fall was more with pre-eclamptic women.

DISCUSSION

Free radicals have a tendency to cause lipid peroxidation. Markers of lipid peroxidation (MDA) are increased during the progression of normal pregnancy. A significant rise in the lipid peroxidation product MDA was observed in both study groups when compared with the control group. Several workers (1, 18, 19, and 20) have studied increased lipid peroxidation in pregnant and non-pregnant women and reported remarkable increase in lipid peroxidation products because of increased oxidative stress in pregnant women.

Study of S Mohanty (21) and Carl A (22) suggests that pregnancy-induced hypertension is associated with excessive free radical formation. There is a highly significant relation between rising blood pressure and increasing free radical activity. In our study we found that, the degree of free radical generation and lipid peroxidation is more in pre-eclamptic women when compared to the normal pregnant women. It might be due to more critical condition that contributed towards increased free radical generation and consequently increased oxidative stress in pregnancy with eclamptia.

Elevation of lipid peroxidation products causes impaired antioxidant enzyme defense mechanism and this imbalance may contribute to the pathogenesis of pre-eclamptia. Yildiz (23) observed increase in Catalase and decrease in Glutathione levels in pre-eclamptic women. Similarly Sharma et al (24) found increased levels of oxidative markers like MDA and decreased level of SOD in pre-eclamptic women suggesting that oxidative stress plays a significant role in the pathophysiology of pre-eclamptia. Tevfik (25) also suggested that oxidative stress contributes to the patho-physiological mechanism of pre-eclamptia and antioxidants might have a protective role in the scavenging of free radicals. They found high levels of MDA and Catalase. Pinar (26) found high levels of antioxidant enzyme activity SOD and CAT in pre eclampsia. According to them the protective antioxidant mechanism are complex and multifactorial. It is possible that during gestation the increase antioxidant activity is in response to the oxidative stress. Exact mechanism of this is not yet known. But Simmi (27) reported low levels of SOD activity in pre-eclamptia because of the red cell dysfunction. Similarly Zhou (28) and Veronica (29) found low levels of SOD, Catalase, and GSH-Px in pre-eclamptic women. They suggested that decreased levels of antioxidant biochemical markers are related to the severity of the oxidative stress. Pre-eclampsia is a hypertensive disorder of pregnancy in which antioxidant defenses system fail and tissues are injured.

The present study depicts a statistically significant increase in MDA and a fall in antioxidant enzymes reflecting increased oxidative stress in pregnancy. Pre-eclamptic pregnant women show higher degree of oxidative imbalance as compared to the healthy pregnant women so care should be taken during this period to minimize the pathogenesis caused by free radical damage.

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